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LONDON: PUBLISHING OFFICES, 6, BUDGATE HILL, E.C.4. SUBSCRIPTION per annum. Postage inclusive, in Great Britain, £1 1s. 8d. Canada, £1 3s. 10d. ($5.50): to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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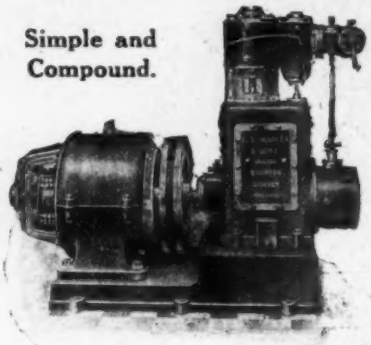

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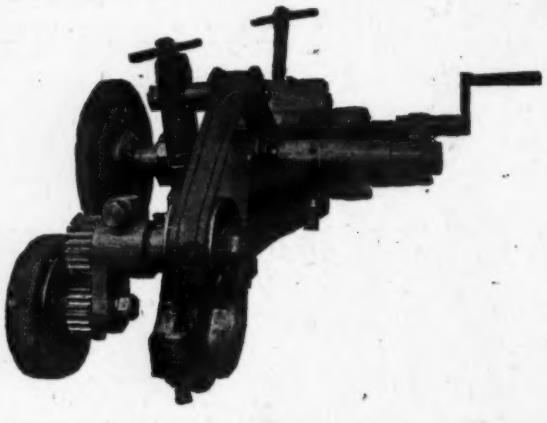

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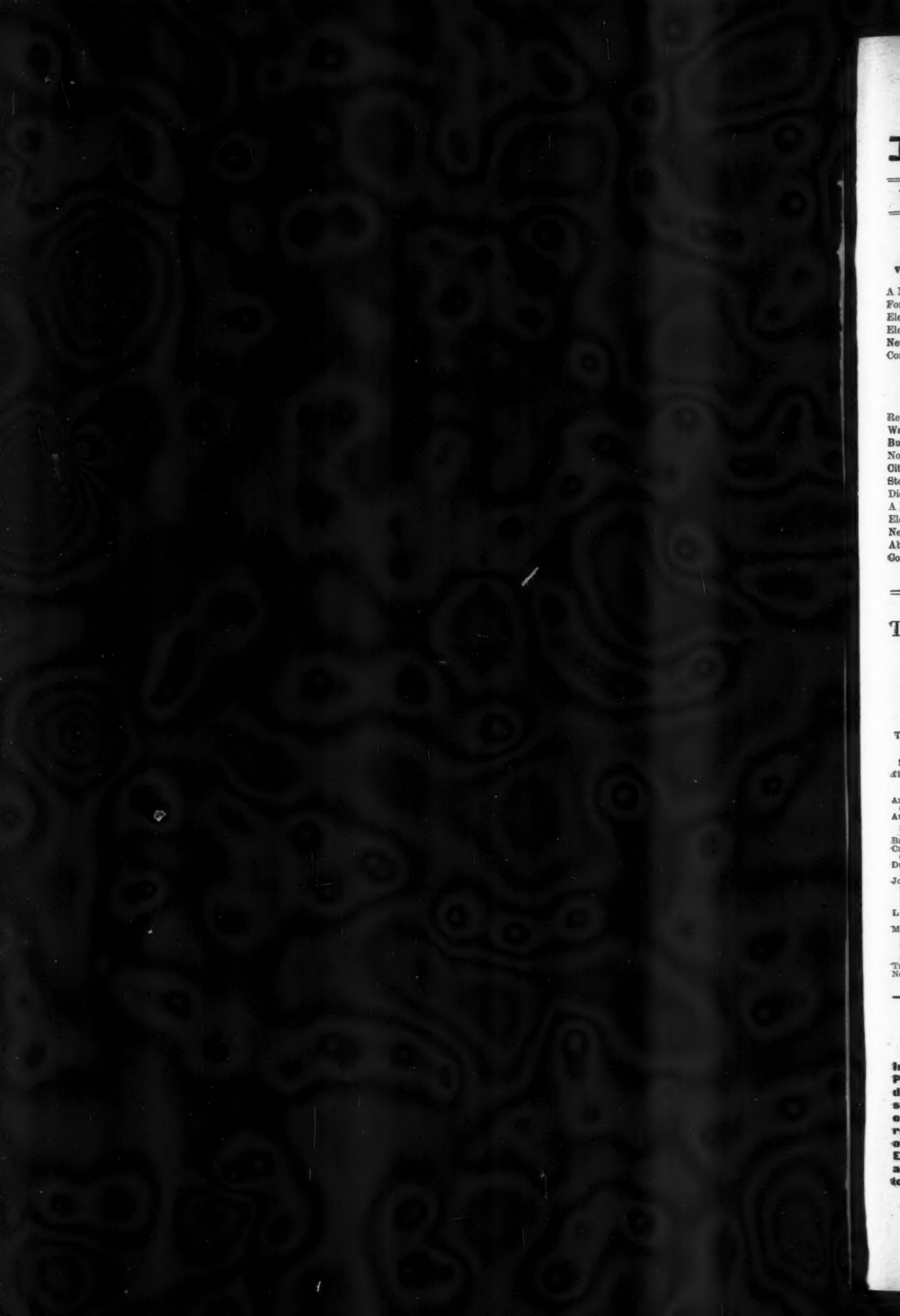

THE

# ELECTRICAL REVIEW.

VOL. LXXXII. MAY 17, 1918. No. 2,112.

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## A NATIONAL PROVING HOUSE.

THE discussion on this subject which took place at the Institution of Electrical Engineers last week was highly interesting and profitable, and should bear valuable fruit. Moreover, it was preceded by several announcements by the President which again call forth our congratulations to the Council on the maintenance of its progressive policy, and the promptitude of its action in connection with important industrial developments, which are reported in our "Notes" columns to-day.

The subject of the meeting was one with which we have identified ourselves for many years, particularly in connection with Canadian trade; before the war we repeatedly brought this matter to the notice of our readers, and endeavoured in every possible way to arouse their interest in the immense possibilities of Canada as a market for our manufacturers. One of the principal obstacles to the development of this opening for trade in electrical appliances was the firm establishment throughout the Dominion of the standards of the Underwriters' Laboratories of Chicago, and in our issue of January 3rd, 1913—to quote merely one instance—after discussing an exhaustive report by Mr. C. Hamilton Wickes to the Board of Trade on the constitution and operation of these Laboratories, we expressed emphatic agreement with his view that a similar institution should be formed on this side of the water, to act in conjunction with the Chicago organisation. By no other means could the necessary "hall-mark" be conferred upon British manufactures, to enable them to command acceptance in North America; unless they bore the authorised label they stood no chance whatever of gaining popular recognition.

Six months later we were glad to announce that a branch of the Chicago Laboratories had been formed in London, Messrs. Heap & Digby having been appointed engineers in Great Britain to the Chicago institution, and authorised to inspect and approve articles for Canada before they left the British factory—thus removing the heavy handicap involved by the necessity previously incurred of having them inspected after arrival in the Dominion. This arrangement came into operation, and was in force until the war broke out and diverted attention from the subject.

The subject of the discussion was a familiar theme to Mr. Wordingham, to whom is due the credit for having brought it forward no less than 20 years ago; again in May, 1913, he pressed the matter upon the attention of the Institution, and the Industrial Committee recommended the establishment of a national proving house; but the then Council of the I.E.E. rejected the scheme as having a "political" tendency,* and turned it down, shortly afterwards extinguishing the Committee itself. *Tempora mutantur*—and what a salutary change has come over the Council! Truly, we are making progress at last. Mr. Wordingham published his scheme in our issue of July 24th, 1914, p. 124, and we tender him our hearty congratulations on the coming fruition of his ideas, on practically the very lines which he then advocated—and now with the support of the I.E.E. Council.

By a coincidence, we had in hand at that date an article outlining a similar proposal, which we pub-

* ELECTRICAL REVIEW, May 22nd, 1914, p. 854.

lished in the following issue (ELEC. REV., July 31st, 1914, p. 193); we have pleasure in stating that the author, who then preferred anonymity, was Mr. C. Turnbull, whom we join with the President in our congratulations.

As regards the present scheme, while there is no need to discuss the details of its organisation, we are glad to note that the Director of the National Physical Laboratory, Sir Richard Glazebrook, promised his cordial co-operation, and that the Secretary of the B.E.A.M.A., Mr. D. N. Dunlop, expressed the approval of his Association. Mr. C. le Maistre, Secretary of the British Engineering Standards Committee, speaking unofficially, also heartily endorsed the proposals of the Council, and we have no doubt that they will be supported by the whole industry. All is now, therefore, plain sailing, and we hope soon to see this excellent and long-wanted institution established on a firm basis. We have referred above to its connection with Canadian trade, and there is no question that this has had a great deal to do with the matter; but the benefits to be derived from the National Proving House will be by no means confined to this particular market—they will be felt in every market, at home and abroad, to which our manufactures penetrate.

**Foreign Languages and Trade.**

IT cannot be said that the British commercial world has done its best to encourage the study of foreign languages. Too many boys destined for clerical and such-like careers in commerce leave school with only a very slight acquaintance with other tongues besides their own. Only in special cases here and there have employers encouraged their young employés to complete this half-knowledge, or to learn other languages. We have met merchants who attached little importance to such qualifications because they could always get translation work done at such-and-such a rate at a bureau run by some foreigner or other. Then, when a member of the staff had grown up with and learned the business itself so as to be capable of going on a tour of representation abroad, he was bound to be at a disadvantage because he knew little beyond his own native language. Who has not known cases in which a foreigner has been engaged to travel abroad for a British house partly because his credentials included linguistic attainments? The best course surely is to send British men who know the business, and to encourage them in good time to learn languages likely to be of assistance in the markets that the firm intends to develop. We trust that we are getting away from our old neglectful ways to-day, in view of the approaching need for strong representation in many foreign countries where our own language is only slightly used. In the past it was so easy and so cheap to engage a German clerk for office work that an English lad with linguistic knowledge was not appreciated and paid as he should have been. We hope that we have learned the lesson well, and that we shall be on our guard in the future. The dangers attending our neglect of business languages, so obvious to many of us to-day, are emphasised by the report of the Government Committee which has inquired into the "Position of Modern Languages in the Educational System of Great Britain." Too many of our sons have been spending years learning Greek and Latin when they ought to have been otherwise occupied. We shall be extremely unwise if we allow them to carry present-day justifiable prejudices to such an extent that they neglect German. The evidence collected by the Committee testified to the fact that in the past business operations had been hampered by British ignorance of foreign languages, and heads of firms who did themselves possess such knowledge showed how valuable it had been to them in their trading relations. Those who testified that English was the leading language of commerce, and desired that we should try to make its use universal, may have stated a fact, but not one that would justify us in ignoring the conditions prevailing in South America, Russia, China, Spain, Italy, and some other important markets where Germany found her way in because her agents were equipped with a knowledge of the languages of those countries. There are tens of thousands of potential purchasers in the world who do not know half-a-dozen words of English. Are we to tell them to learn English first if they want to do business with us? If that is to be our attitude we deserve to lose in the trade competition that will confront us. Surely we know by now the uselessness of circulating abroad correspondence and catalogues limited to our own language, prices, and weights and measures. Few firms of standing in the electrical trade are likely to fall into the error of ignoring that warning in the future. The Committee concludes its report with a number of recommendations which we trust will be acted upon. It is unfortunate that the war-time shortage of paper, or, shall we say, its use for what to us are unessential purposes, should prevent the fullest possible publicity being given throughout the length and breadth of the land to these recommendations. It needs to be widely known that after an exhaustive study of the subject the Committee advises that the business community in every considerable centre of foreign trade or of manufacture for foreign markets should take steps in conjunction with the education authorities to further the formation of institutes of languages, both for full-time and for part-time study; also that business men should encourage the study of foreign languages by those members of their staffs who possess good business ability, and show capacity for such study, by inducing them to attend such institutes; also that commercial houses and industrial firms should bring to the knowledge of the school authorities the opportunities that present themselves from time to time for all those who have special aptitude for foreign languages. In conclusion, we would suggest that at the present time, when our business houses are so dependent upon junior staffs, employers, managers, and heads of departments might give these assistants fatherly counsel upon the subject, and impress upon them the necessity for fitting themselves at once for the foreign trade conditions of the next few years.

**Electric Power Supply.**

THE Bill promoted by the British Aluminium Co. to enable it to obtain an increased supply of water-power for the production of aluminium was up for second reading in the House of Lords on April 30th, but, although it was supported by the Board of Trade and the Ministry of Munitions, it met with strong opposition mainly on the ground that the generation of power from our natural resources was a question of national importance, and ought not to be dealt with piecemeal by a commercial concern for private profit. It was urged, also, that a work of such magnitude could not be completed, and ought not to be put in hand, during the war, and eventually the Bill was withdrawn.

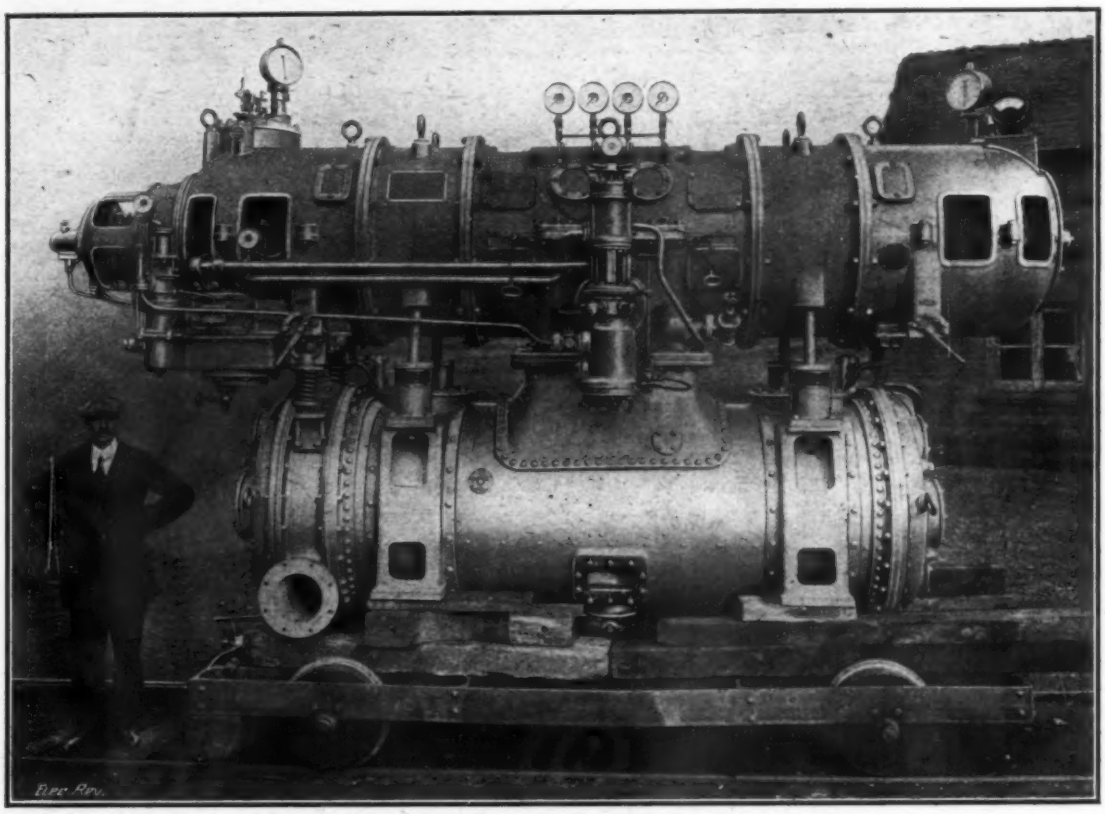
The question of national policy was raised also in connection with the third reading of the Shropshire, Worcestershire, and Staffordshire Electric Power Bill, the debate on which was adjourned till after Whitsuntide. Evidently, therefore, the idea of reorganisation of electricity supply on a national basis is receiving very serious consideration in Parliamentary circles. We sincerely hope that the result will not be merely to delay the progress of electricity supply.

# ELECTRIC SHIP PROPULSION BY THE LJUNGSTRÖM TURBINE.

As mentioned in our last issue, we recently paid a visit to the North-East Coast to inspect the machinery of the first British sea-going merchant ship propelled by electricity—the s.s. *Wulsty Castle*, of 6,000 tons, which has been built by Messrs. John Blumer & Co., of Sunderland, to the order of the Lancashire Shipping Co., Ltd. (Messrs. J. Chambers and Co., Liverpool). The installation is of exceptional interest, not only because it marks a new era in British marine engineering, but also because the prime mover is the Ljungström steam turbine, a machine of unique design and construction, highly efficient, and of light weight.

In our issue of October 10th, 1913, we gave an illustrated description of this turbine, which was developed some three years previously by Mr. B. Ljungström, a Swedish engineer, and is manufactured in this country by the Brush Electrical Engineering Co., Ltd. A more detailed description by Mr. R. S. Portham was abstracted in our issues of May 5th and 12th, 1916. The turbine is of the radial-flow type, with no fixed guide-blades, the blading being carried in concentric rings on the faces of two disks which revolve in opposite directions. These disks are mounted on short shafts, which are bolted to the ends of the rotor shafts of two three-phase alternators, and are entirely overhung, so that the two rotors can be uncoupled from the generator shafts and removed together, without disturbing the rotors of the generators. The total weight of the two rotors and blading of a 1,000-KW. set is only about 5 cwt. As the relative speed of the two sets of blading is twice the actual speed of either, and the turbine is of the reaction type, the conditions enable a very high efficiency to be attained. Steam enters at the centre, and flows out radially through the interlacing sets of blades, being discharged into an exhaust chamber which surrounds the rotors; thence it passes immediately into the condenser, upon which the turbo-generator is mounted, the turbine casing being bolted directly to the condenser inlet. As will be seen from the accompanying illustration, this is the only rigid support of the generating set, so that no provision for expansion is required; stout steel springs bear the weight of the machine at either end.

The two alternators are normally electrically coupled in parallel, automatically synchronise whilst running up to speed, and run as one machine. A single exciter is mounted on the outer end of one of the generator shafts, and excites both fields in series. The speed is controlled by a centrifugal governor actuating an oil relay, and an emergency device is provided, which cuts off the steam by releasing the oil pressure if the speed becomes excessive, or if the bearings overheat. Forced lubrication is provided by an oil-pump, which also supplies oil under pressure to control the stop-valve.

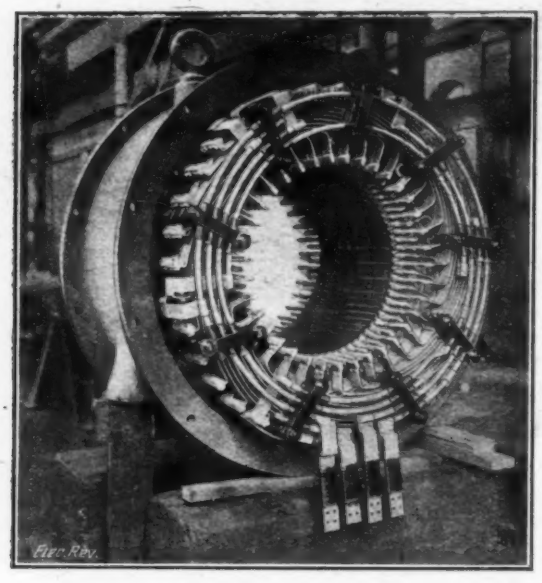


LJUNGSTRÖM 625-KW. TURBO-GENERATOR FOR THE "WULSTY CASTLE."

Owing to the high relative speed of the two rotors, the number of rows of blades is only one-fourth of the number required in an ordinary reaction turbine; the whole of the revolving parts are mounted symmetrically on solid disks, so that there is no liability to distortion due to temperature changes, and the highest degrees of superheat can be safely employed. The turbine is exceedingly compact, the whole set being smaller than an ordinary reaction turbo-generator.

In the paper by Mr. Portham, mentioned above, which was read before the Institution of Engineers and Shipbuilders in Scotland, the author dealt very fully with the application of the Ljungström turbine to marine propulsion, and gave particulars of tests carried out on two Swedish steamships—the *Mjölner* driven by two of these turbines, and the *Mimer*, a sister ship driven by triple-expansion reciprocating engines; under the same running conditions, the fuel consumption of the former vessel in service was 38·6 per cent. less than that of the latter, and the turbine equipment showed a relative reduction in weight and space occupied of 25 per cent. Maintenance costs in 16 months' running

were practically nil, and no breakdowns were recorded. Owing to the high superheat permissible and the characteristics of the turbine, the gain in thermal efficiency fully compensates for the losses due to electrical conversion; an astern turbine is unnecessary, as the motors are reversible, and the boiler plant is reduced in proportion to the steam consumption of the propelling plant.



Stator of the Ljungström Generator.

While the *Wulsty Castle* is the first British ship equipped with the Ljungström system, she will not long remain the only one; several Swedish ships have been fitted with it, and the contracts completed, or in course of execution, for installations varying from 1,000 to 6,000 s.h.p., amount to 102,000 s.h.p., no fewer than 45 British, American, and Scandinavian ships being concerned.

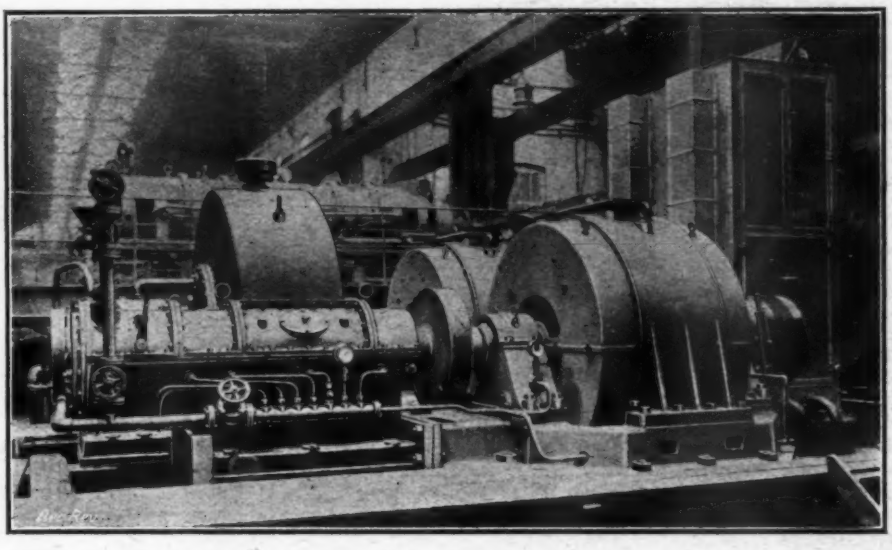
Turning to the installation on the *Wulsty Castle*, one's first impression of the engine room is one of spaciousness. The centre is occupied by the motors and gearing; at either side is a turbo-generator and condenser, and above is empty space up to the bridge deck, offering a striking contrast to the engine room of a ship driven by reciprocating engines. Each turbo-generator consists of two three-phase alternators coupled to the turbine rotors, each machine having a full-load output of 312·5 kw. at 650 volts, 60 cycles, and running at 3,600 r.p.m. Thus each set has a total output of 625 kw., giving an aggregate output of 1,250 kw. The rotors are of the bipolar revolving-field type, consisting of solid steel forgings, in which slots are milled to receive the windings; the latter are of heavy copper strip, completely formed before insertion in the slots, and are insulated with mica between turns and between the coils and core. Each rotor carries a fan for cooling the machine; axial ventilation is employed throughout, and the ducts are so arranged that they can be cleaned without stripping the machine. The heated air is carried off by trunks to the Howden preheating plant, to be further heated by the exhaust gases from the boilers, and finally fed to the furnaces, no other fans being necessary.

The stators of the generators are wound with one solid bar per slot, insulated with a seamless mica tube; the end connections are of very massive flat strip, supported by specially designed brackets. An exciter is directly coupled to each set. The machines are specified to run at full load for six hours without exceeding a temperature rise of 65° F.

The turbines are run up with exhaust to the atmosphere, oil under pressure being provided by separate steam-driven pumps; on the attainment of a certain speed the auxiliary oil, circulating, and air pumps automatically come into operation, and the steam oil pump shuts down. The circulating pump is of the Pulsometer type, driven by an 18-b.h.p. motor; the air pump, of the Kinetic type, and the condensate pump, both made by the Pulsometer Engineering Co., Ltd., are driven by 15-b.h.p. Brush vertical-shaft motors. All the auxiliary motors are of the squirrel-cage induction type, and both sets can be supplied with current from either generating set; the motors are controlled by Berry switches, mounted on switchboards at the after end of the engine room, but in practice they are run up simultaneously with the generators. The condenser is of the Contraflo type, made by the Brush Co.

The main driving motors are of the ventilated enclosed type, with enclosed slip rings, and are mounted side by side in the middle of the engine-room; each is coupled by a heavy flexible coupling to the shaft of a pinion gearing with a large double-helical spur-wheel, made by the Power Plant Co., and completely enclosed.

The motors are each capable of a continuous output of 785 h.p. with a temperature rise not exceeding 65° F., and have an overload capacity of 120 per cent. without stalling. They are fitted with brush-lifting and short-circuiting gear, to avoid friction loss and wear of brushes, and are designed for the highest possible efficiency, the guarantee being 94 per cent. at full load. The stators are wound with a single bar per slot, insulated with seamless mica tubes; the rotor windings are of the cylindrical-barrel type, involving special designs to ensure a positive drive of the rotor spiders and windings, on account of the high peripheral speed and quick reversals. Ventilation is effected by fans mounted on the spiders. The slip rings are of gunmetal, and are mounted on an extension of the shaft outside the bearing, as shown in one of our illustrations. The bearings are of the pedestal type, with split spherical bushes and removable caps, and are provided with forced lubrication. Each motor is carried on a bed-



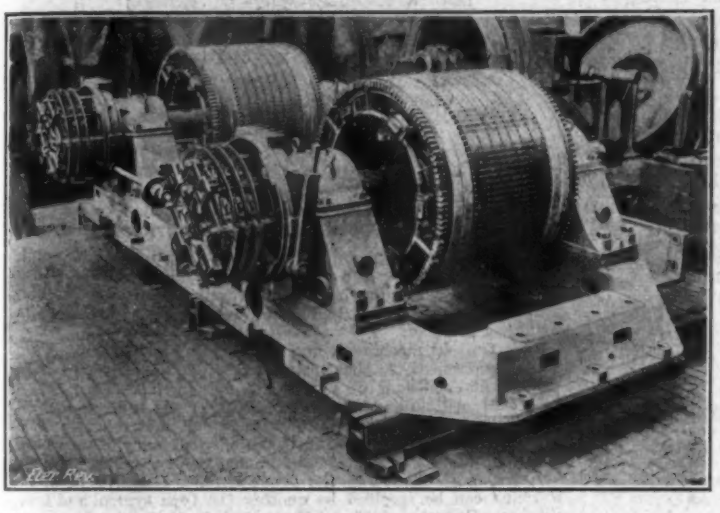
Induction Motors and Gearing.

plate extended to join up to the gear casing. The motors run at 714 R.P.M., and the propeller shaft, which is coupled to the large spur-wheel, at 76 R.P.M. The total speed ratio, generator to propeller, is therefore about 47 : 1, and the shaft H.P. is about 1,500. An oil pump is mounted on the after end of each pinion shaft, and the propeller shaft is provided with the Michell thrust-bearing.

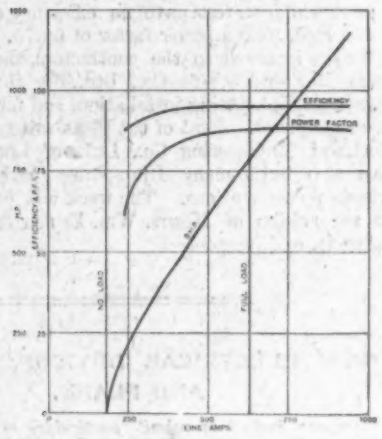
The manœuvring gear is wholly comprised on a panel at the forward end of the engine room, mounted on the front of a cubicle containing the controlling apparatus. The speed of the motors is regulated by inserting resistance in series with the rotors; the resistances are of the liquid type, consisting of two sets of cones of a cast-iron alloy, the lower ones being stationary and filled with potash solution, while the upper ones are carried on vertical spindles, which are raised or lowered by a hand-wheel mounted on the front of the panel, the weight of the cones being counterbalanced so that the effort required to turn the wheel is nominal. Rotating the hand-wheel from the mid position through a right angle in either direction causes the propeller to rotate in the same direction, at a speed corresponding to the angle through which the wheel is turned. In the mid position of the wheel the upper cones are lifted entirely out of the liquid, the rotor circuit is broken, and the motors are stopped. At full speed the cones are nearly in contact, and the resistances are cut out by a short-circuiting switch. The liquid is circulated through coolers by small motor-driven Pulsometer pumps, and the brush-lifting gear on the motors is mechanically interlocked with the manœuvring gear, so that the brushes cannot be raised unless the gear is in the full-speed position, nor can the gear be moved from the stop position unless the brushes are down. Reversal is effected with the hand-wheel in the stop position by one electrically-operated oil-type reversing switch, which reverses two of the phases in the stator circuits. The switch is so designed that each motor can be supplied from either generator, singly or in parallel. The rheostats regulating the excitation of the generators are geared to the main hand-wheel so as to prevent an undue variation in voltage when the hand wheel is turned; the rheostats can also be operated by hand. Oil switches with overload trips are provided in the motor stator circuits, and oil switches with overload and reverse trips in the generator circuits. The instruments mounted on the panel include one bus-bar voltmeter, two watt-hour meters in the generator circuits, two ammeters (one in each generator circuit), and two exciter voltmeters; synchronising gear for paralleling the generators is mounted on a bracket attached to the manœuvring panel. The whole of the manœuvring gear is housed in a cubicle close to the motors, as shown in our illustration; the cubicle is built of channel and angle-iron framework covered with steel plates, hinged doors of perforated metal being provided at the sides to give access to the gear.

The cubicle rests on the coolers for the electrolyte, and the cables from the various machines are brought into a seating below the coolers; the connections between these cables and the gear are of solid copper rod, carried in ducts at the back of the cubicle. Most of the switches and instruments were supplied by Messrs. Switchgear & Cowans, Ltd. The wiring consists of three-core armoured cable.

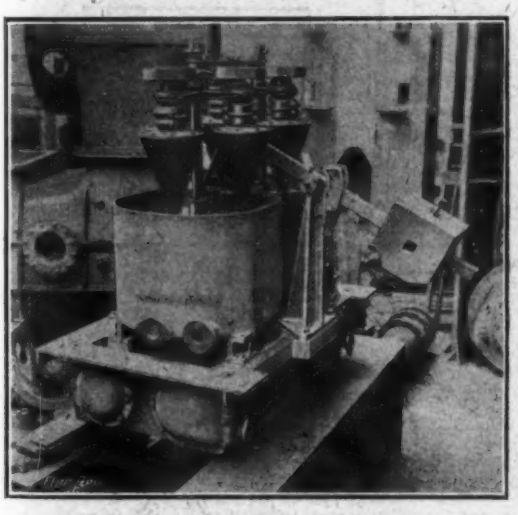
D

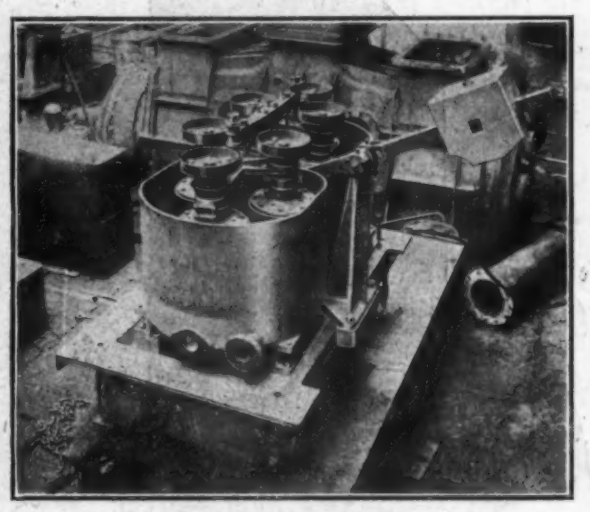


Rotors and Brush-gear of Motors.




Efficiency and Power-Factor Curves of Motors.





Liquid Controlling Resistances, in "Stop" and "Full-speed" Positions.

A small lighting set is provided, consisting of a de Laval turbine coupled to a 20-KW. motor-generator set, comprising a three-phase motor and a D.C. compound-wound generator working at 60 volts, 1,720 R.P.M. The turbine drives the dynamo, with the motor uncoupled, when the main generators are shut down, but normally the turbine is uncoupled and the motor drives the dynamo. This set can also be used for exciting the main alternators in case of emergency.

The steering gear is electrically controlled, of the Hele-Shaw-Martineau type—a 20-B.H.P. three-phase motor actuating an hydraulic telemotor. Normally the steering engine only absorbs about 5 B.H.P., and it is extremely sensitive.

The accompanying curves show the characteristics of the motors, which on test gave an efficiency of 94·8 per cent., at full load, with a power factor of 0·875.

We are indebted to the contractors, the British Ljungström Marine Turbine Co., Ltd., for the opportunity to inspect this interesting installation, and for the illustrations here reproduced. Most of the plant was made by the Brush Electrical Engineering Co., Ltd., of Loughborough, who have also built many Ljungström turbo-generators for British power stations. The work was carried out under the supervision of Messrs. Wm. Esplen & Son, consulting engineers, of Liverpool.

## NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

*Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.*

### Ironclad Cubicle Switchboard.

A 15,000-volt "Witton" ironclad cubicle switchboard is depicted in the accompanying illustration, fig. 1. The whole of the apparatus, including isolating links, instrument transformers, and so forth, is included in the cubicle, and very special care has been taken to give adequate clearances. The oil switch has a capacity of 200 amperes, and is constructed of steel throughout, there being one tank per phase. By means of a simple tank-lifting device, any

FIG. 1.—15,000-VOLT IRONCLAD "WITTON" SWITCHBOARD.

tank can be removed to inspect the switch or replace the oil. Despite the size of the switches, the design is such that they can be easily operated by hand. The doors at the back which give access to the whole of the apparatus are interlocked with the oil switches, giving the well-known "Witton" mistake-proof characteristics. This switchboard was constructed by THE GENERAL ELECTRIC CO., LTD., of Witton, Birmingham, and 67, Queen Victoria Street, London, E.C. 4.

### B.T.H. Induction Motors.

We have received from the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, their new illustrated descriptive list, No. 2,142B, on two and three-phase induction motors. The illustration, fig. 2, shows a slip-ring induction motor (type IX, form M) with special drip-

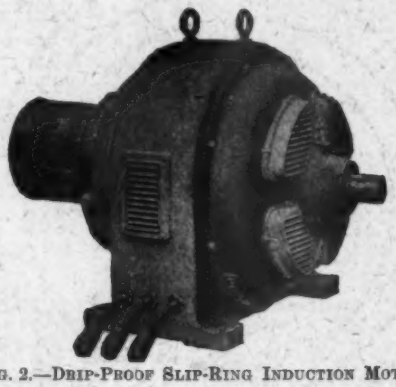


FIG. 2.—DRIP-PROOF SLIP-RING INDUCTION MOTOR.

proof covers, fitted to the openings in the frame and end shields. These covers, while allowing efficient ventilation, protect the motor from falling dirt and drippings of water such as is likely to be met with in mines.

This type of machine is one of three different types that have been standardised, so that motors up to 450 H.P. capacity and to meet most conditions of service can be supplied. Type IX embraces all medium and large motors, both of the squirrel-cage and the slip-ring forms; it also covers the small squirrel-cage motors up to 10 H.P. Two- and three-phase motors of any of the above types can be designated by the additional letter Q or T respectively. Numbers are assigned to the frame sizes, so that the size of any machine can be specified by quoting the type symbol and frame number. Form letters K and M are used for the squirrel-cage and slip-ring motors respectively.

### Automatic Control for High-Rated Electric Furnaces.

The accompanying diagram, fig. 3, shows an arrangement whereby variable voltage operation of three-phase electric furnaces can be accomplished by changing the high-voltage connection. The high melting voltage is obtained by connecting the high-voltage windings in delta and the lower refining voltage by connecting them in star. During the melting period variable voltage is obtained by means of high-voltage taps, and external reactance is provided to be cut in during this melting period. The furnace is

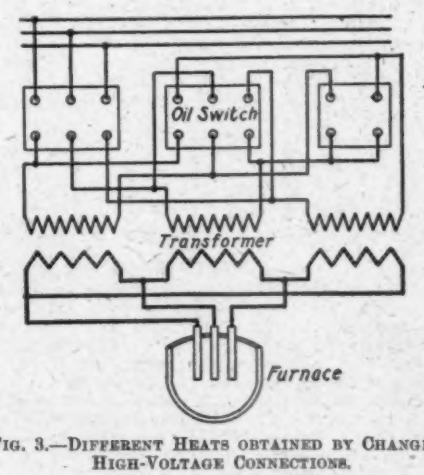



FIG. 3.—DIFFERENT HEATS OBTAINED BY CHANGING HIGH-VOLTAGE CONNECTIONS.

equipped with a three-section control panel containing three shunt relays and three contactor groups. Contact-making ammeters are also provided, with dash-pots to prevent hunting of the electrode motor, and the coils are provided with taps which are used to vary the amount of power supplied to the furnace. Each contactor group consists of three units all mechanically interlocked, two contactors being normally open and the other being normally closed. The motor for operating the electrodes is dynamically braked so that all moving parts may be stopped instantaneously. The installation as described is manufactured by the General Electric Co., U.S.A.—*Electrical World.*

### Temperature Conversion Table.

We have received from the CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., of Cambridge, their new temperature conversion table in the form of a spiral 100 in. long, which occupies the centre of a card and shows individual degrees from absolute zero up to 2,000°, both in the Centigrade and Fahrenheit scales. On the same card there

are also conversion formulæ and a number of other tables such as temperatures of saturated steam at various pressures, specific heats at normal temperatures, thermal conductivities at normal temperatures, proportions of mixtures for quenching and

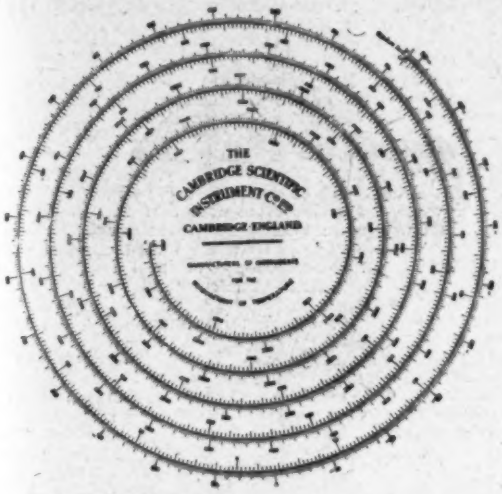



FIG. 4.—TEMPERATURE CONVERSION TABLE.

tempering baths, useful standardising points, &c. The tables, which are clearly printed on stiff varnished cardboard, should be found useful by many who may have occasion to use them. They can be had on application, with stamps to cover postage (6d.).

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The 12½ per cent. Bonus.

With reference to your correspondent's ("Technical Clerk") letter *re* the above in your issue of May 10th, if "Technical Clerk" and other clerks in similar positions who have not received the 12½ per cent. award will kindly communicate with our General Secretary, 13, Brunswick Square, London, W.C. 1, or myself, we shall be pleased to inform them how to proceed to secure this bonus.

**Ben Griffiths,**
*Welsh Organiser, National Union of Clerks.*

47, Queen Street, Cardiff,
*May 11th*, 1918.

### Report on Post-War Trade.

I entirely agree with the words contained in the leader which appears in your issue of May 3rd :—

"The hour has not yet struck for the profitable discussion of this great subject, but sooner or later it will come prominently before the nation, which, under the influence of war and war-time revelations, has developed some of its thinking."

Truly, when one reads carefully the report of the Balfour Committee on Post-War Trade Policy, and peruses side by side with this the report of the eighteenth annual general meeting of the British Westinghouse Electric and Manufacturing Co., Ltd., and then refers to the reports of the last meetings of the Metropolitan Carriage, Wagon and Finance Co., Ltd., Messrs. Vickers, Ltd., and the British Trade Corporation and the directorates of these companies, "it gives one furiously to think."

Whilst I am entirely in sympathy with the passage you quote from the report, namely, that "every encouragement should be given by the Government to the formation of combinations of manufacturers and others concerned with securing supplies and materials," we must not lose sight of the principles involved in this recommendation. The present life and death struggle between the forces of democracy and autocracy illustrates more clearly than anything else could have done that the same laws which govern the destinies of nations control those of industry and commerce. Thus in the national interest, and more especially in that of the smaller, and therefore weaker, producer, trader, and manufacturer, those of us who possess sufficient prevision to influence those in authority to avoid excesses, must employ all the energy we possess to make assurance doubly sure that no misrepresentations or misunderstandings will be permitted to prejudice constructive action based on the recommendations of the Balfour Committee. Whilst I agree with your conclusions that the Committee considers it generally undesirable that the State should attempt to provide capital for industrial purposes, and I, with you, believe that industry will find it more satisfactory to rely upon its own efforts and the efforts of private banking enterprise and the Trade Bank Corporation, than to look to the State, I venture to assert that the Board of Trade, the British Trade Corporation, and the industrial community at large will in the future have to take exceedingly broad views in these matters if the cures which they recommend for the ills from which in pre-war days we suffered are not to prove more disastrous than the diseases themselves. Human nature being what it is, I repeat what I said at the time of the formation of the British Trade Corporation, that success or failure in all these matters must in the future depend upon the three m's—management, magnanimity, and men.

**Edward Berkeley.**

London, E.C., *May 8th*, 1918.

### Joints on Triple-concentric to Three-core Lead-covered Cables.

I am obliged to Mr. Williams and Mr. Balshaw for their correspondence on the above subject in the issue of May 3rd, but regret that Mr. Williams dealt so briefly with the matter in order to illustrate and describe a class of joint other than that which appeared in my article on April 26th. The fact also that Mr. Williams has been a jointer for 24 years does not in the least give me any idea as to what his completed joint would resemble ; therefore I should be glad if he would illustrate his method of jointing a three-core L.C. to a T.C. lead-covered cable, if possible by an actual photograph, and also give particulars as to the size of the cables on which this class of joint has been made.

With reference to Mr. Balshaw's letter, the method he has adopted certainly looks neat in the sketch, but here again an actual photograph would be an advantage, and convey to one a better idea. However, I am not in any way disputing the merits of this class of joint ; but, in fairness to my article, I might here mention that I omitted to state that the insulation on the T.C. cable was jute, and not paper, and after being underground for 20 years it needs very careful handling.

The method of jointing described by Mr. Balshaw is one that I have often thought of, but never yet found it practicable to work each strand of the cored cable to lie flat all round the intermediate and outer cores of the concentric cable so as to make a neat joint and also to ensure each strand being sweated down. For instance, after opening out a 3-core and binding down to the intermediate of the concentric, I cannot imagine the complete joint looking so neat as Mr. Balshaw illustrates.

It would also be interesting to know how long it takes to make a complete joint of this description previous to fixing the lead sleeve.

In conclusion, I should esteem it a favour if your correspondents could grant me the privilege of seeing an actual photograph of their completed joints, should they at any time have one in their possession.

**P. Wardle.**

Electricity Works, Carlisle,
*May 11th*, 1918.

**Electrification Progress in Scandinavia.**—In a lecture recently delivered before the Royal Institute of Engineers, Holland, A. Groothoff reviewed the present electrification situation in Sweden and Norway.

The first electrification on a large scale in Sweden was the Kiruna-Riksgränsen line with its tonnage of iron ore of more than 3,000,000 tons per year, and this within the Arctic Circle. The line is 93 miles long. Single-phase current at 80,000 volts is transmitted from Porjus to four transformer stations, of which the first is 87 miles and the last 160 miles distant from Porjus. The voltage is stepped down to 15,000, at which pressure power is supplied to the contact device. The freight locomotives weigh about 100 tons and the passenger locomotives 70 tons. A normal freight train consists of two electric locomotives and 40 ore cars of 46 tons each, the total weight being from 2,000 to 2,100 tons. Normal speed for freight is 18½ miles per hour; the maximum speed being 31 miles per hour. The maximum speed for passenger trains is 62½ miles per hour. In the first year this road transported 1,104,000 tons of ore, which is barely one-third of its normal capacity. Despite this low traffic, it showed a saving over steam operation, due partly to the high price of coal. The continuation of the road southward to Svarton, on the Baltic coast, has been decided upon, and the cost of the extension, 143 miles long, has been figured at $7,800,000. With an annual ore transportation of 3,000,000 tons, electric traction can compare favourably with steam traction when coal is $6.70 per ton. The power for the whole road is to come from Porjus. Whether or not other State railroads in Sweden will be electrified is still an open question. The problem is not an easy one, for while electrification would increase the capacity of the roads, it cannot do very much, because most Swedish railroads are single track. This limits the total traffic, regardless of motive power. In 1917, Norway had a total of 1,970 miles of railroad track, of which 44½ miles were electrified. Plans are under way for the electrification of several short lines owned by the State. A comprehensive plan for the complete electrification of all the State railways has also been worked out, involving the expenditure of $14,000,000 for the power stations alone.—*Electric Railway Journal*.

## REPORT ON THE PROTECTION OF ESSENTIAL INDUSTRIES.

Lord Balfour's Committee on Commercial and Industrial Policy has issued an "Interim Report on Certain Essential Industries." (Cd. 9,032. 2d.) It does not deal with the larger and staple trades, but with certain special commodities which, though of less magnitude industrially, are absolutely indispensable to important British industries, and were supplied from enemy sources before the war. Steps have been taken by the Government to deal with the maintenance of permanent supplies here of synthetic dyes and spelter. In regard to tungsten, it is considered essential to the safety of the nation that this should be manufactured within the Empire after the war on such a scale as to supply domestic requirements, and afford a margin for export, so that any sudden increase in our own requirements may be readily met. This object will be secured if sufficient supplies of ore are ensured, and the eight or nine reduction works in this country are maintained and kept efficient. It is necessary to secure to British manufacturers a first claim upon the supplies of ore available within the British Empire. The Committee sets out the recommendations of the Engineering Industries Committee framed with the object of preventing any attempt on the part of foreign agencies to "corner" the available supplies within the Empire. It is proposed by that Committee that all wolfram or other ores containing wolfram should pay an export duty on leaving the Empire, of £25 per ton, and the Balfour Committee approves of the recommendations on the understanding that the charge of £25 per ton when exported without a Government certificate be imposed as a penalty, and not as an export duty in the proper sense of the term. It is recommended that a special grant be made to manufacturers to cover the extraordinary expense that they have incurred in establishing works and increasing their plant during the war, and it is suggested that the amount and the conditions, &c., should be determined by a special Board, referred to below.

Magnetos naturally receive a good deal of attention in the report, and information has been furnished by the Admiralty, the War Office, and the British Ignition Apparatus Association, and the Ministry of Munitions has also been conferred with. The case of magnetos affords a typical example of "key" industries, and is one which was virtually monopolised before the war by the Bosch Co., of Stuttgart. It is estimated that prior to the war some 300,000 magnetos were imported into this country, and that about 90 per cent. of these were supplied by the Bosch Co. "But for the large stock held in this country by that company, the military position at the outbreak of war would have been very serious." The report says:—

> Since the war a number of British firms have undertaken the manufacture, and with the assistance of certain Sheffield firms as regards magnet steel and magnetos, have succeeded in producing magnetos of a very high quality. The successful establishment and maintenance of the industry in this country are . . . . clearly of very great national importance. The Bosch magneto, is, however, the outcome of a long series of investigations and constant improvements, and the powerful German company, which is also established in the U.S. as a separate concern, is not likely after the war to abandon its market in the United Kingdom without a strenuous effort to recover it. Accordingly, although in our opinion there is no reason why the British industry should not establish itself firmly in due course, we consider that it will require some special assistance during the first few years after the war.

The British Ignition Apparatus Association made the following proposals:—

1. That the Bosch Magneto Co. in London be wound up immediately.
2. That all enemy patents relating to magnetos be voided for their possible duration.
3. All magnetos or other ignition apparatus, including parts for the same, should be protected in the following manner:—
   (a) Countries now at war against us—total prohibition for at least five years. After this period a minimum of 33⅓ per cent. import duty.
   (b) All other countries—a minimum of 33⅓ per cent. import duty for five years, and 20 per cent. minimum after five years.
4. All Government Departments should purchase only British-made magnetos or other ignition apparatus, and specify the same for all subsidised vehicles.
5. No undertaking should be allowed to manufacture magnetos or other ignition apparatus in this country if they are in any way controlled by capital obtained from enemy countries or subjects.
6. It should be insisted upon that all goods be plainly marked on the article itself, where it is clearly visible, with the country of origin.
7. That all advertisements relating to foreign-made goods should clearly state the country in which the goods referred to are manufactured.

The first proposal is already being carried out, and as regards the second, the necessary steps under the rules made under the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, are being taken by the responsible departments concerned in consultation with the British manufacturers.

As regards proposals 3 (*a*) and (*b*), British manufacturers are likely to be able to satisfy the home demand for magnetos within a reasonable time after the war ends. In order to maintain the industry in this country against the competition of the powerful Bosch Co., it will be necessary to prohibit the importation of magnetos of present enemy origin for an initial period of five years after the war, subject to licence. The British magneto is, as a rule, superior in quality to the American, but, in view of the fact that the manufacture has been set up under war conditions, and will require time to adapt itself to normal commercial purposes, it cannot compete in price with the American article. In these circumstances it is recommended that for the period of five years a duty equivalent to 33⅓ per cent. *ad valorem* should be imposed on magnetos and other ignition apparatus and parts thereof imported from all sources other than the present enemy countries or under licence from those countries. At the end of five years the question should be reconsidered with a view to a progressive reduction of the duty.

As regards the fourth proposal above, the opinion of the Admiralty, in which the representative of the Ministry of Munitions was disposed to concur, was that, in view of the progress made by the industry in this country, such an undertaking might now safely be given. Objection has, however, been taken on behalf of the War Office on the ground that it is essential that the Government ought not to be debarred at any time from obtaining the most efficient ignition apparatus from whatever source. In view of the necessity of maintaining the industry in this country, it is recommended that an undertaking should be given experimentally for a period of three years after the war, that the Government Departments which are purchasers of motor cars and aeroplanes will stipulate in their contracts for British-made magnetos. The stipulation should be conditional upon the application of a strict standard of excellence and the maintenance of reasonable prices.

The proposals 5, 6, and 7 raise important questions of general policy to be dealt with separately.

Other essential industries referred to in the report are:—Optical and chemical glass; hosiery needles; thorium nitrate; barytes; and limit and screw gauges. After dealing with these several "typical industries," the Committee turns to the subject of principles which emerge as the result of its investigations, and says:—

"A particular commodity or branch of production which is of great national importance at a given time may not continue to be so, and, on the other hand, new essential industries may emerge in the future.

"The causes which have rendered British trade dependent upon the present enemy countries for the supply of particular commodities are by no means uniform, and the measures required to promote the various branches of industry involved may vary with each individual commodity. The problem will also be affected as new economic and political condition arise and changes occur in the international situation.

"In the future industries of the nature dealt with will always require special and separate consideration, and no general measure will be sufficient to meet their varying requirements. Consequently, it is impossible to lay down permanent and uniform lines of State action in this connection, or to frame an exhaustive list of such industries as may from time to time call for exceptional treatment, or to elaborate in detail the precise measures which may be needed in each case. The special recommendations made in the report may themselves require modification to meet the conditions which may actually exist after the war.

"In these circumstances we recommend the establishment of a permanent Board (which might be called the Special Industries Board) charged with the duty of watching the course of industrial development and of framing from time to time, when necessary, either on its own initiative or on the application of interested departments or persons, detailed schemes for the promotion and assistance of industries concerned with the production of commodities of special character.

"This organisation should take the form of a board of commercial and industrial experts, associated with whatever department of State is entrusted with the care of the commercial and manufacturing interests of the country, and represented in Parliament by the political head of that department. It should be a statutory body with a permanent chairman, and with power to appoint such secretarial and technical staff as it may require from time to time.

"It should be a statutory condition that, except upon its recommendation, no State assistance by way of grant or subsidy should be given to any industry or branch of industry. It should work in close relation and co-operation with the Department of Scientific and Industrial Research, and all other departments of the State interested in the development of industry, and it should always be cognisant not only of naval and military requirements as they affect industry, but also of the current political relationships of this country, since changes in these respects may obviously bring to light fresh 'essential' industries."

The maintenance of efficient and adequate production at reasonable prices must be a condition of the continued receipt by an industry of special State assistance in any form.

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**The Metric System in the U.S.A.**—In view of the great demand for information on the metric system for the use of the U.S. Forces in France, and for the use of the War and Navy Departments at home, as well as for manufacturers of war materials, the U.S. Bureau of Standards has been distributing, on request, copies of its publications on the International Metric System. These include a descriptive pamphlet, a graphic chart, a metric comparison scale, a circular giving definitions and tables of equivalents, a report on the metric system in the export trade, and a supplement to the table of equivalents giving the millimetre-inch equivalents. In view of an order recently issued by the Ordnance Department, adopting the system for use for specified purposes, the demand for the charts for the instruction of officers, aviators, and others, has been especially heavy.

## WAR ITEMS.

**Trading with the Enemy.**—The "London Gazette" for May 10th contains official certification of territory in Russia which, in connection with Trading with the Enemy Proclamations, is regarded as territory in hostile occupation.

**Electrical Lieutenants.**—By an Order in Council it is declared that Commissioned Warrant Officers of the Electrician Class who have completed three years' service in Commissioned Warrant Rank will on retirement be granted rank corresponding to that of Lieutenant, R.N., with the title Electrical Lieutenant.

**Ministry of Munitions Orders.**—By Order of the Ministry of Munitions, as from June 1st a variety of engineers' and machinists' small tools (which are specified—see *London Gazette*, May 10th) must not be manufactured without special licence. Persons engaged in the business are to make returns concerning their business as required.

An Order has also been issued revising the maximum prices of sulphuric acid as fixed by Order dated May 29th, 1917.

**Exemption Applications.**—At Blackpool Tribunal, Mr. C. Furness, tramways manager, appeared for a tramway permanent-way foreman, aged 35, Grade 2, and married. He stated that they ran 1¼ million car-miles per annum. Owing to the lack of material the tramway track was in a worse condition than ever before. He had recommended to the Committee putting on another gang of at least 30 men, otherwise they would run to a standstill. It would mean the top-covered cars coming off, and it was, therefore, more essential than ever that the man should be retained. He was a foreman in charge of 30 men. Temporary exemption until September 30th was granted.

At Heckmondwike, the District Council applied for a stoker at the electricity works. The application was lodged some months ago, but was adjourned. The Council stated that the works could not be carried on with any less staff than was there at present, and all efforts to get a substitute had failed. The taking of this young man, who was now the only stoker, would stop the works, and deprive many industrial establishments of power and light. The National Service Representative held that the Tribunal had now no jurisdiction, and submitted that power could be got from Thornhill. It was agreed that a deputation should interview the Dilution and National Service Authorities at the regional headquarters.

At Shoreditch, J. Hind, aged 42 years, C 1, Eldon Street, E.C., electrical merchant, made a fourth application on business grounds, and was granted four months, Sec. B, V.T.C.

At Carlisle, the National Service Representative appealed against exemption granted to R. J. Cooke (38, Grade 2), a driver in the employ of the Tramway Co. The manager urged that the man's services were very much needed for instruction purposes now that women drivers were to be allowed. The appeal was acceded to, and the exemption cancelled.

The West Kent Appeal Court has disallowed exemption, with 28 days' grace, to M. A. Jarrett (30, Grade 2), a driver on the Maidstone Municipal tramways. The local tribunal had previously withdrawn his exemption.

On a review, the Clacton-on-Sea Tribunal has confirmed conditional exemption held by A. H. Jennings (38), who has sole charge of the electricity plant and the X-ray apparatus at the Middlesex Military Hospital, on the ground that he is in a certified occupation.

At Bath, the National Service Representative asked for the withdrawal of exemption held by two drivers with the Electric Tramway Co., A. C. Derrick (31, Grade 2) and W. E. Greening (36, Grade 2). The company did not oppose the application, although the men were skilled drivers, and would be much missed. The Clerk: Perhaps when there have been a few fatalities the National Service Authorities will alter their demands. The exemptions were cancelled.

The Epsom Rural Tribunal has refused exemption to W. H. Pack, engineer at the Leatherhead electricity works.

An appeal by J. A. Brine (40, B 1), electrical engineer, of Chiddingstone, has been dismissed by the West Kent Appeal Court.

An appeal to the West Kent Appeal Court by J. H. Baxter (31, Grade A), electrician, of Tovil, Maidstone, has been rejected by the Court.

The Southport Tribunal has granted exemption until June to a student of electrical engineering at a Manchester College, to enable him to sit for his examination. He is 18, and in Class C 1.

At Oxford, the Electric Tramways Co. appealed for M. F. Sadler (34, Grade 2), unit adjustor. The manager, Mr. A. A. Tyler, said that the man was of poor physique, but was just able to do the work, and they had no man they could train to take his place. Captain Segar urged that in a month a man could be trained to do the work. The appeal was refused, the calling-up being delayed for two months.

Before the Herts Appeal Court, an appeal was filed by M. J. Connari (Grade 2), electrical engineer, of Watford, but exemption was refused, together with a request for medical re-examination.

At Swindon, the Corporation appealed for A. J. Vizor (40, Grade 1), tramway inspector; A. E. Chislett (Grade 1), C. Chamberlain (37, Grade 2), H. O. Cull (35, Grade 2), H. H. Tunley (34, Grade 3), and F. Cole (38), drivers. The manager (Mr. T. Medcalf) said that it was necessary to have thoroughly expert drivers on the Corn Exchange route, and he pointed out that the trams were now carrying 35,000 more passengers weekly than before the war. Vizor was given six months, Chislett a final month, Chamberlain and Cull six months each (temporary), and the cases of Tunley and Cole (rejected) were not dealt with.

At Dover, the Corporation electricity department appealed for further exemption for G. Hopkins (Class A), coal and ash trimmer. He was ordered to be called up in three months' time.

At Folkestone, the cases of A. Goodenough (33, B 1), commercial and analytical clerk, and Mr. Jenkins (32, A 1), chief clerk, with the Electricity Supply Co., were considered. Col. Daniel said that he was inclined to say "Blow the regulations," and use common-sense; he thought it imperative that these men should stay. The former was given conditional exemption, and the latter three months.

At Chatham, in the case of 18 employés of the Tramway Co., which were to be reviewed, it was decided that the whole of 40 cases should be considered *en bloc*. Meanwhile the whole question is being considered by the Dilution Officer, the Labour Bureau, and the Local Advisory Committee. Three of the men, M. Poulter (37), motorman; A. Tonge (39), armature winder; and N. S. Metcalf (34), motorman, having left and entered the dockyard, had their exemptions withdrawn, and it was decided to represent the facts to the dockyard authorities.

Brixworth Tribunal has granted final exemption to June 30th to an electrical engineer at Althorp, who is in charge of the waterworks there.

## BUSINESS NOTES.

**Patent Application.**—Mr. A. G. M. Michell, of Melbourne, is applying for an extension of Letters Patent No. 875, of 1905, for "Improvements in thrust and like bearings."

**A Large Stoking Plant.**—Erith-Riley stokers, constructed in Lancashire by Erith's Engineering Co., Ltd., 70, Gracechurch Street, London, have been ordered for the largest-unit boilers in Europe, viz., for double-ended Richardsons-Westgarth boilers, 20,700 sq. ft. heating surface, hourly evaporation 100,000 lb. from and at 212°, corresponding to about 6 tons slack coal hourly, at the Bow power plant of the Charing Cross Electric Supply Co., Ltd. These units are remarkably compact, the total area occupied, including the stokers, being only 23 × 36 ft., or 828 sq. ft. For convenience of working, a central wall divides the unit into two parts, each with its 12-retort Erith-Riley stoker burning 3 tons of coal an hour.

At Fulham electricity works, the Erith-Riley stokers are two-thirds the size—viz., eight-retort stokers burning 2 tons of coal hourly; all sizes, from four-retort to twelve-retort inclusive, are used in British central stations, and many repeat orders have already been completed.

**Australian Electrical Trade.**—In our last issue we referred briefly to the annual report of the Electrical Employers' Association of New South Wales. We have since been favoured with a complete copy of the report, which is signed by Mr. A. D. Stevenson, the president, and Mr. N. Phelps Richards, the secretary. Supplementing the notes already quoted, we find that inability of power houses, mines, and industries to obtain extension machinery has gradually been bringing development of the electrical trade to a standstill. "Had it been possible to procure heavy machinery, there is every reason to believe that the trade would have progressed normally in spite of the war. The supply of the smaller materials needed, such as wires and accessories, although dear, has kept pace reasonably well with the demand. Individual firms, especially those engaged on maintenance work, have kept themselves fully and profitably occupied, but many of our less fortunate members feel the effects of the growing depression." In regard to the new local manufacture of accessories mentioned last week, the report says:—"It remains to be seen whether these manufactures can be successfully continued in the face of a renewal of competition from abroad, but the fact is established that such goods of excellent quality can be made in our workshops. It is reasonable to expect that this development of our industry as applied to goods of a special nature—for instance, such as cannot be standardised and made in large quantities—has come to stay. The advance of scientific and technical training in our university and technical schools will undoubtedly contribute to this result." The report refers later to useful activities of the Association in respect to the restriction on supply of electricity in Sydney, a certain measure of relief being obtained, also in regard to industrial arbitration, conditions of contract, wiring rules, apprenticeship, &c. The conditions of contract duly adopted for wiring work have been printed and put on sale, and the various Government departments have been approached with a view to the adoption of the conditions for Government as well as for private work. The conditions of contract for the supply of materials to the various Federal and State Government Departments, Municipal Councils, &c., have been under attention. As a general rule, the Association finds that these Departments, when brought face to face with the question of amending their conditions to suit the exigencies of war, are

prepared to meet members in a reasonable spirit. The Supply Houses Committee has completed a model set of standard conditions for use with contracts for annual supplies, for application after the war.

In the *Board of Trade Journal* we find remarks on the present position and the future prospects of the electrical industry in Australia which were made by the President of the New South Wales Section of the Electrical Association of Australia at its annual meeting held recently. He stated that the war had given a great impetus to the manufacture in Australia of electrical apparatus, and that large orders had been placed locally which would otherwise have gone abroad. Had the firms been quite prepared to execute the orders, they would have received a much larger volume of work. Power is required for the development in New South Wales of large electro-chemical and electro-thermic industries, for which there is said to be a distinct field. It is probable that eventually the water powers of New South Wales will be harnessed, in spite of the fact that coal is very plentiful, of excellent quality, and cheap.

Considerable water power can be developed economically for the purpose of establishing manufactures, and the result of investigations shows that 100,000 KW. could be delivered on the sea-coast line, derived from the waters of the mountain ranges of the State. This would enable producers to manufacture all products of the electric furnace, including not only steel, but carborundum and alundum as abrasives, graphite for electrodes, and to engage in the preparation of lubricants, calcium carbide for lighting, cyanide for fertilisers, alkali for all purposes, and, in all probability, aluminium. There being no alternative—delivery being required soon—orders for electrical machinery have been placed with local manufacturers at exceptionally high prices. When the war is over, however, the position will be altered. Active competition from established works abroad will be intensified owing to many manufacturing countries making a bid for the trade. Local factories will not be in a position for some years to manufacture on a large scale, and the only way of meeting this competition will be to impose a heavy protective duty or to reduce the cost of labour. A reduction of wages, however, is very unlikely.

**Dissolutions and Liquidations.**—W. P. THOMPSON AND CO., patent agents, 285, High Holborn, London, W.C. 1.—Messrs. W. P. Thompson & H. Sefton Jones, dissolved partnership as from October 1st, 1917. The assets and goodwill have been acquired by the acting partner, Mr. H. Sefton Jones, who will attend to accounts. Mr. W. P. Thompson remains interested in the firm of W. P. Thompson & Co., of Liverpool, as hitherto. Mr. H. Sefton Jones, who has been sole acting partner in the late firm for more than 20 years, continues the London business at the above address, in partnership with Messrs. A. E. Odell and A. J. Stephens, as Sefton Jones, Odell & Stephens.

PINTSCH'S ELECTRIC MANUFACTURING CO., LTD.—Meeting June 14th, at Friars House, New Broad Street, E.C., to hear an account of the winding up from the liquidator, Mr. H. W. Kirby.

CALMON ASBESTOS AND RUBBER WORKS, LTD., London.—Winding-up order made May 7th.

AUTOMATIC ELECTRIC BLOCK SIGNALLING CO., LTD.—Meeting, June 19th, at 47, Parliament Street, London, S.W., to hear an account of the winding up from the liquidator, Mr. A. Colls.

CALVERT'S CIRCULATION FUEL ECONOMISER, LTD.—Meeting, June 17th, at 36, John Street, Bedford Row, London, to hear an account of the winding up from the liquidator, Mr. F. J. Drane.

BRIMSDOWN LAMP WORKS, LTD.—The controller, Mr. H. J. Morland, has applied for his release.

TAYLOR & CO., mica merchants, 40, Hatton Garden, London, E.C.—Miss Taylor, the founder of this business, and Mr. Moritz Ignatz Bergl have dissolved partnership. Mr. Bergl has retired. The business will be continued under the same name, and at the same address, by Miss Taylor, with skilled engineering assistance.

Our Australian contemporary, *Tenders*, states that under the Trading with the Enemy Act, the Minister of Customs has directed the winding up of the business in Australia of the Australian Thermit Co., Ltd.

**Catalogues and Lists.**—MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E. 7.—Twelve-page list, S 2/1—4, containing full description, with half-tone and diagrammatic illustrations of their all-steel draw-out truck type switchboards.

BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C. 4.—Twelve-page illustrated price list (No. 10,401), giving particulars of various types of fittings for industrial lighting; also a supplementary list giving illumination data for industrial lighting, including a double-page illumination chart. Copies of both lists may be had on application.

THE CLAUGHTON CO., 8, Exchange Street, Manchester.—Copy of No. 1 of a small monthly magazine published by them—"Power Plant Transmitter"—of which copies will be sent to anyone interested.

**Book Notices.**—*Metric Weights and Measures and British Equivalents.* By A. J. Lawson. M.Inst.C.E. London: Eyre and Spottiswoode, Ltd. 211 pp. Price 5s. net.—This work, which is printed in English and Italian, consists mainly of tables of British decimal coinage, metric and British weights and measures, which were originally prepared by the author for his own use, and have now been extended with a view to their being of service to others; it is published under the ægis of the British-Italian Commercial Association, a body which has rendered great services to both countries by fostering trade relations between them, since its formation in 1916 as the British-Italian League (Economic Branch). The author has taken great care to ensure the accuracy of all his data, and of the tables as printed.

The contents cover a wide range of subjects, embracing practically all the classes of goods interchanged between Italy and Great Britain, as well as their coinage systems; but their purpose is far more general, as the tables will be of the greatest use in engineering and other works, shops, offices, &c., in all branches of commerce and industry in which conversion from British to metric units, and *vice versâ*, is necessary. The author regards the early adoption of the decimal system in this country as a matter of certainty, and in dealing with coinage has based his tables upon the proposals of the Decimal Coinage Bill which is now before Parliament—the pound sterling subdivided decimally. Tables for the conversion of prices from the old to the new system are given, as well as for converting lire into sterling, and *vice versâ* (at par value). Next follow very full tables of conversion for measures of weight, length, area and volume, tables of multipliers, specific gravities of materials, tensile strengths, pressures, stresses, areas and circumferences of circles, thermal data, gravity, railway tables, mensuration, tables for use in curve-ranging, earthworks, &c., and in appendixes a number of interesting items. It is impossible to examine this mass of tabular matter in detail, but we can say at once that—while of course there is no limit to the variety of tables of compound values that could be drawn up, and this work does not profess to cover them all—we have never met with any similar production that meets so many and so varied needs; the tables are admirably set out and printed on stout paper, and the book is strongly bound. Objection may be taken to the excessive number of significant figures employed, extending in many cases far beyond the requirements of commercial or industrial users; but we understand that the author's aim was to ensure against deficiency in this respect—any user, of course, can employ just as many figures as he finds necessary and sufficient. We heartily welcome this work, which arrives at a most opportune moment, and we hope that its sphere of usefulness will shortly be enlarged by the adoption of the decimal system all round.

The current issue of *The Channel* contains articles on "The Efficiency Ratio of a Steam Turbine," by R. Gardner; "The Application of Electricity to Various Auxiliaries on Shipboard," by H. L. Hibbard; "Notes on Electric Furnaces," by F. H. Whysall; and a variety of Clydeside and other interesting items.

"Annual Report of the Smithsonian Institution, 1916." Washington: Government Printing Office.

Messrs. Constable & Co. will publish almost immediately a new edition, re-written and enlarged, of "Industrial Electrical Measuring Instruments," by Kenelm Edgcumbe, which has been out of print for some little time. Messrs. Constable will also publish almost at once "The Production and Treatment of Vegetable Oils," by T. W. Chalmers, in their "Engineer Series."

**France.**—A new company has lately been formed at Boulogne, near Paris, with a capital of £40,000 and the title La Société de l'Usine Moderne de Location de Force Mor Motrice de Billancourt, the object apparently being to establish electrically-operated workshops to be let out to small manufacturers.

**Trade Inquiry.**—A British subject in Marseilles desires to secure agencies for British manufacturers of electrical material, accessories, glass shades, &c., for house and factory lighting. Ref. No. 126, *Board of Trade Journal*.

**Trade Announcements.**—MESSRS. VENNER TIME SWITCHES, LTD., have removed their offices and works to 6, Earl Street, Westminster, S.W. 1, where all inquiries should be addressed in future. Telephone No.: "Victoria 4550."

MESSRS. TREDEGARS, LTD., of Diana Place, Euston Road, announce that their manager (Mr. Bedbrook) has opened a new depôt at Birmingham at 47, Exchange Buildings, and will attend to all inquiries for that district.

MESSRS. DRAKE & GORHAM, LTD., announce that the address of their wholesale department and stores will in future be 67, Long Acre, W.C. 2, where they will be able to stock large quantities of metal-filament lamps and other electrical requirements.

## LIGHTING AND POWER NOTES.

**Bexhill-on-Sea.**—PRICE INCREASE.—The T.C. has decided further to increase the price of electricity by 10 per cent., a total of 25 per cent. on the pre-war scale, and to advance the meter rent to prepayment consumers from 1s. to 2s. 6d. per quarter.

**Birmingham.**—WAR BONUS.—The City Council, last week, granted the 12½ per cent. war bonus to manual workers in the certified departments of the Corporation (electricity, gas, tramways and water).

**Brighouse.**—YEAR'S WORKING.—There is a surplus of £330 on the working of the electricity undertaking for the year.

**China.**—The *Board of Trade Journal* contains the following notes from H.M. Consul-General on the chief industries of the Province of Yunnan:—

There are two privately-owned companies at present engaged in the electric lighting industry in the Province of Yunnan.

The first to commence operations, and the largest, is a company at Yunnanfu, with a power house at Shih Lung Pa, where the fall of water from the lake into the river is utilised. The plant consists of two 150-KW. alternators driven by turbines. Electricity is generated at 23,000 volts, three-phase, 50 cycles, and is brought into the city at this voltage by a transmission line some 30 English miles long, and transformed down at a sub-station at the West Gate of the city to 3,000 volts, at which voltage it is distributed to

various centres, and again transformed down to 110 volts for lighting purposes.

Difficulty has been experienced with the transmission line, and a station was erected last year about halfway with lightning arresters, but without very much result. Energy is sold at a flat rate of $1 per month per 16-C.P. lamp, and at the rate of 30 cents per unit for consumers who have meters. The total cost of the installation is estimated at about $600,000. The machinery was manufactured by Messrs. Siemens, Schuckert & Co., and supplied through a local agency.

The contract for all supplies during the war has been secured by a British firm, and it is hoped that very shortly a British engineer will be engaged to replace the German who was formerly in charge of the plant.

The second installation is at Mengtaz, and consists of a British-made alternator, direct coupled to an engine of British manufacture, which is supplied with steam from a boiler of the same make. The alternator works at 6,600 volts, three-phase, 60 cycles, with an output of 80 KW. It is intended to connect up with the neighbouring tin mines of Kotchiu by a high-tension transmission line, a distance of about 15 miles, and to supply the mines with cheap power and light. It is estimated that 1,000 H.P. will be required for the mines alone, which will necessitate the installation at Mengtaz of a turbine plant of this capacity and of the latest design. The engine room has been designed with a view to accommodating two 1,000-H.P. steam turbine sets.

High-tension lines are run through the City of Mengtaz to the various transformers, at which the voltage is stepped down to 110 for lighting purposes. The only coal available is a very low quality soft grade, necessitating the use of steam blowers with the boilers. Electricity is sold to the city at the same rates as are charged by the first-mentioned company. The plant has been in operation about 15 months.

**Continental.**—SPAIN.—In a debate on railways, in the Senate on May 3rd, says the *Daily Mail*, Senor Cambo said the Government was occupied with a large scheme for the development of hydro-electric energy, and hinted at the existence of a plan to utilise this energy for the running of the main railways of the country. The industrial development of the country is hung up for lack of communication and transport, which is dependent on coal at present. It is stated that there is enough water power in Spain to do the whole work of the country, and it is of interest to note that practically all the hydro-electric plant in the country is of German manufacture, whose usual commercial forethought has been displayed in a systematic cultivation of the subject, as well as in a good deal of surveying and buying of properties where power can be developed on a large scale.

A concession has recently been granted for the establishment of a plant to utilise the water power of the River Ebro near Merindal de Castilla la Vieja in the generation of electrical energy for lighting and power purposes.

La Sociedad Electra Vasca Montanesa has lately applied for a concession to utilise certain available water power near Santander. It is proposed to establish an electric power station in which two turbo-generator sets will be erected, one of 1,050 H.P. and the other of 520 H.P.

DENMARK.—A trust company has applied to the Danish Government for a concession to utilise the Gude river for electric generation purposes according to plans already drawn up by the engineers, Thomsen and Faber. The damming of the river will involve the flooding of some 1,000 acres of land; but as the trust has come to an understanding with the owners regarding indemnification for displacement, the realisation of the scheme is ensured.

AUSTRIA-HUNGARY.—On Saturday last, according to the *Daily Mail*, the large hydro-electric power station at Cavedine was bombed and destroyed by Anglo-Italian airmen, and it will be some time before it can be put in working order again. Ordinarily these works supply light and power to Riva, Trent, and most of the other towns and communities in the Lower Trentino. An important effect of the raid will be the stopping of the electric railway from Trent, up the Val di Sole, to Fucine, an important link in the Austrian line of communications.

NORWAY.—The power-transmission line from Florli to Stavanger was recently completed, and is ready for service, awaiting only the completion of the power plant at Florli. This will make 12,000 H.P. available for the Stavanger Electric Co., to be used for lighting and power.—*U.S. Commerce Reports.*

SWEDEN.—Two new companies have lately been formed—one at Uttran and the other at Tillinge—to establish small central electricity supply stations in the respective towns.

A new company has lately been formed at Mgolby, with the title the Elfkulla Kraft Aktiebolag, to establish a small electricity generating station in that town. The Aktiebolag Elektrolytverke is the name of another new undertaking which has lately been organised at Vasteras, with minimum and maximum capitals of respectively £140,000 and £420,000, to establish works for the electrolytic production of metals.

**Cork.**—COAL SHORTAGE.—The Electric Lighting and Tramways Co., Ltd., has issued an appeal to users to economise in every way in the consumption of electricity. The coal shortage threatens a very serious situation in relation to the electricity supply.

**Darwen.**—LINKING-UP SCHEME.—At the last meeting of the T.C., Councillor J. B. Thornley said the Government scheme for linking-up the electrical stations from Darwen to Colne was receiving consideration, but the fact that none of the towns had any surplus output defeated one object the Government had in view—namely, for one Corporation to come to the assistance of another in case of emergency.

YEAR'S WORKING.—There was a loss of £1,867 on the electricity undertaking for the past year.

**East Africa.**—LOURENCO MARQUES.—The Electric Light Co. has notified consumers that if they sign an agreement, they will be charged 6s. monthly for five units, with 1s. 3d. for each additional unit, plus 2s. meter rent. Those who do not sign the agreement will be charged the old rate of 2s. 3d. per unit, plus 4s. monthly for meter rent.

**Edinburgh.**—FUEL ECONOMY.—A Sub-Committee of the Electric Lighting Committee has had under consideration the position of the Portobello power station in connection with the Coal Conservation Committee's report. Several plans were submitted to the Sub-Committee by Sir Alex. Kennedy with reference to the station, showing the extended area supplied by the city, the convenience of the station to the Lothian coalfields, and the possibilities of extension. The Sub-Committee remitted the whole matter to the full Committee, with a view to its being submitted to the Town Council, which will decide what action should be taken.

**Glasgow.**—A Provisional Order to authorise the Clyde Valley Electrical Power Co., of Glasgow, to raise additional capital, has been submitted to the Secretary for Scotland, and is at present under consideration.

**South Africa.**—STRIKE.—The engineers and fitters employed at the Johannesburg municipal power station are demanding an increase in their wages from 2s. 10d. to 3s. 4½d. per hour. On May 11th, the employés, whose demand was not granted, came out on strike, and from noon all the services were held up. At a mass meeting the men decided not to return until all their demands were conceded. The T.C. after a meeting decided not to agree to the men's demands. The centre of the city is without light, and no tramcars are running. The Strike Committee permitted a certain amount of lighting in the suburbs, but owing to the T.C.'s attitude the facilities for lighting the suburban areas have been withdrawn.

**Kettering.**—PLANT ADDITIONS.—The Electricity Committee has recommended the installation of new circulating water pipes, at a cost of £425, and that the necessary parts be obtained for the repair of the air pump, a P. 4 certificate having been obtained in each case.

STREET LIGHTING.—The Committee has decided to discontinue until further notice all public street lighting.

**Limavady (Co. Londonderry).**—The Board of Guardians, following on a report by Mr. A. Robinson, L.G.B. inspector, have approved of a suggestion that they should approach the local Technical Committee with a view to a joint electric lighting installation.

**London.**—SOUTHWARK.—PRICE INCREASE.—The Electricity Committee recommends a further increased charge of 10 per cent. to all consumers of electricity as from March 31st last.

PRICE INCREASE.—The Kensington and Knightsbridge Electric Light Co., Ltd., notifies a further 10 per cent. increase in the charges for electricity to private consumers, making 30 per cent. in all, as from July 1st.

L.C.C.—LOAN SANCTIONS.—The Finance Committee recommends the sanction of the Council to the borrowing of £3,000 by the Hammersmith B.C. for electricity purposes, and of £18,195 by the Woolwich B.C. for new buildings, boiler-house plant, coal conveyer, &c., for the electricity department.

LAMBETH.—RESTRICTION ORDER.—The B. of G. has had its attention directed to the Order reducing the lighting in its various institutions, and has considered the desirability of approaching the B. of T. with a view to securing a special licence to permit the Guardians to have sufficient supplies to meet their requirements; but before taking action in this direction, and in order to ascertain that strict economy is being exercised, it has instructed the chief officers of the institutions and also the caretakers of relief and other stations to submit a monthly return showing the meter readings to date as compared, where possible, with the figures for the corresponding period of last year.

**Maidenhead.**—The T.C. has offered a supply of power to the new works of Dolland & Co., Grenfell Road, at 1¼d. per unit for the first 2,4000 units per annum, 1¼d. for the next 10,000, and 1¼d. beyond, with a minimum of 24,000, and ordinary rates for lighting.

**Nelson.**—PRICE INCREASE.—The Electricity Committee has decided to increase the charges for electricity by ¼d. per unit for lighting and ¼d. per unit for power.

**New Zealand.**—A licence for 42 years has been granted to the Waikuku Town Council to erect and maintain electric transmission lines for lighting, power, and heating. The price of electrical energy is not to exceed 1s. per unit for lighting purposes, and 6d. per unit for power, heating, or cooking purposes. "Lighting purposes" includes the operation of motor-generators for lighting purposes.—*Board of Trade Journal.*

**Sheffield.**—At the annual meeting, last week, of the Sheffield Forge and Rolling Mills, the chairman, Mr. C. E. Siddall, in the course of his remarks stated that the tonnage output had increased 50 per cent. during the past two years, and the whole of

their mills would be electrically driven; he was hoping to see the day when there would not be a steam engine in the whole works. He was convinced that electricity was the coming method of operating all machinery; it was also the cleanest method.—*Sheffield Daily Telegraph.*

**Slaithwaite.**—Renewal of E.L. Order.—The U.D.C. has decided to apply for a renewal of the Slaithwaite Electric Lighting Order, which expires in July.

**Stamford.**—Proposed Price Increase.—The T.C. has decided to oppose the proposed increase in the charges for electric light by the Stamford Electric Light Co., which has made application to the B. of T. for a revision of the rates provided for under the Electric Lighting Order of 1900.

**Swindon.**—Revised Charges.—The T.C. has adopted the following new scale of charges for energy:—Public lighting, 20 per cent. increase; power (small consumers), 3d. per unit; ditto (large), 1·8d.; heating, 1½d.; tramways, 1·8d.

**United States.**—Niagara Water Power.—Chief Justice Meredith, with Judges Kelly and Sutherland, as a Special Commission under the Public Utilities Act, has decided that the Electrical Development Co., which is controlled by Sir William Mackenzie and his associates, is not entitled under its charter to develop more than 125,000 H.P. at Niagara for commercial uses, and that the contention that it may exceed this amount if the average quantity used does not exceed 125,000 H.P. is unfounded.—*The Times.*

**Wakefield.**—Loan Application.—The City Council, last week, decided to apply to the L.G.B. for sanction to borrow £6,000 for electricity works extensions.

**Welsh Water-power Resources.**—A Committee has been appointed by the Anglesey County Council to consider the safeguarding of the public interests in connection with the development of the water-power resources of North Wales, and to confer with representatives of the other North Wales County Councils and of the North Wales Branch of the Welsh National Association for Reconstruction as to any steps that should be taken to secure this object.

## TRAMWAY AND RAILWAY NOTES.

**Australia.**—Year's Working.—The annual report of the Fremantle (W.A.) municipal tramway and lighting board to August 31st, 1917, shows that shortly the various tramway routes will be supplied with electricity from the Government power station at Perth, but that some delay will be occasioned in the supply for lighting and power owing to the non-arrival from England of the necessary transformers. The net profit on the whole undertaking for the year was £7,638, against £10,640 for the previous year, the reduction in amount being due to an increase in the working expenses. Traffic revenue, £36,083; lighting revenue, £25,799; total revenue, £65,352; working expenses, £51,328; interest, £6,846; net balance, £7,638; car-mileage, 606,754,178 miles; passengers carried, 4,995,860; average car revenue per mile, 14·272d.

**Belfast.**—Lock-out.—The Corporation has decided to terminate by a week's notice the engagement of all the tramway employés unless the latter withdraw summonses issued against the Corporation for failure to carry out an award of the Committee on Production, giving the men an increase on their war wages of 8s. weekly. The decision means that the whole tramway service of the city will be suspended. The award affected 800 men.—*Morning Post.*

**Bradford.**—War Wages.—To settle the problem of the increase of wages of the employés in the various Corporation departments, the War Wages Committee, last week, decided to offer a general increase of half-a-crown per week, as from March 1st, bringing the advances to 20s. above pre-war rates for men, 13s. for women, and 10s. for youths and girls. This means the suspension of the operation of the award.

Traffic Restrictions.—Mr. C. J. Spencer, the municipal tramway manager, has reported that, in view of Government restrictions on tramway traffic, further curtailment of car services is likely to become necessary from time to time. The Committee has authorised him to alter services as he may deem advisable, as the needs arise.

**Burnley.**—Strike.—The permanent-way men in the employ of the Corporation tramway department came out on strike last week, claiming to participate in a recent war advance of pay granted to members of the National Union of General Workers engaged in the gas department.

**Continental.**—Germany.—According to the *Pall Mall Gazette*, a Zurich telegram says the Frankfort-on-Main tramway power house was completely destroyed by an explosion which occurred there last Friday morning. The explosion, the cause of which has been carefully concealed, destroyed many buildings in the vicinity, and the tramway service cannot be resumed for several days.

Denmark.—The growing scarcity of oil is interfering with the oil-driven traffic in Denmark generally, but in Copenhagen the electric tramway service, thanks to the supply of energy from Sweden by the Helsingborg-Elsinor cable, has been continued uninterruptedly during the past year, a surplus even allowing of large supplies being furnished to the Nordsjelland electric works for traffic and general purposes. The Boulevard tunnel section of the Copenhagen tramways is completed, and was opened to the public on December 1st last.

**Darwen.**—Year's Working.—There is a loss of over £930 on the tramway undertaking for the past year.

**Japan.**—New Underground Railway.—On account of the great congestion in the streets of Tokio, and the urgent demand for better transportation facilities, plans have been completed for the immediate construction of a subway system, 9½ miles long. This will be built in a fairly straight line under the busiest part of the city. The construction work is to be of reinforced concrete throughout, with a track gauge of 4 ft. 6 in., which is widely used in Japan. The third-rail system is to be employed. The sum of 21,000,000 yen has been decided upon as necessary for the project, or at the rate of 2,210,000 yen per mile (1 yen = 50 cents). High-speed service, at five-minute headway, will be given between 5 a.m. and 1 a.m. No cars will be operated from 1 to 5 a.m. The fare is to be 5 sen (2½ cents), and the estimated net profits are given at $970,000, with a guaranteed dividend of 8 per cent. to the promoters. Substantial business men throughout Japan are backing the project, and it is understood that work is to begin at once. In comparing the estimated cost of this project with that of similar undertakings elsewhere, the purchasing power of the yen in Japan must be considered. This is not far inferior to the value of the dollar in the United States. Labour is, of course, far cheaper than in this country, and only a small proportion of the total amount mentioned represents labour costs.

Year's Working.—The report of the Imperial Government Railways for the year ended March 31st, 1916, contains a section devoted to tramway lines proper. The results of the working of these for the year under review are:—

| | Electric. | Other. |
|---|---|---|
| Number of tramways ... | 64 | 74 |
| Mileage open ... | 667 | 587 |
| Mileage under construction | 232 | 56 |
| Passengers carried ... ... | 624,890,286 | 13,592,881 |
| Passenger earnings (yen) ... | 24,882,962 | 1,236,861 |
| Goods hauled (ton)... ... | 468,158 | 843,376 |
| Freight earnings (yen) ... | 334,926 | 466,864 |
| Total revenue (yen) ... | 38,666,330 | 1,991,963 |
| Total expenses (yen) ... | 25,377,798 | 1,519,867 |
| Profit (yen) ... ... ... | 13,288,532 | 472,110 |

—*Electric Railway Journal.*

**Kettering.**—Electrical Vehicle Statistics.—The electrical engineer has submitted the following figures in connection with the electrical vehicle for the nine months ending March 31st last, viz.:—

| | |
|---|---|
| Total mileage covered ... .. .. .. .. .. .. .. | 3,500 |
| Tons coal carted .. .. .. .. .. .. .. .. | 5,409 |
| Tons clinker (works) .. .. .. .. .. .. .. | 993 |
| ,, ,, (destructor) .. .. .. .. .. .. .. | 90 |
| Units used, 5,840, at 1d. .. .. .. .. .. .. | £24 |
| Labour, maintenance, licences, insurance .. .. .. .. .. | £138 |
| Interest and sinking fund .. .. .. .. .. .. | £155 |

Running costs for the year, 1s. 3d. per ton.
Estimated saving on the basis of 1s. 10d. per ton, £190.
The vehicle has not been out of commission for a single day.

**Liverpool.**—Year's Working.—With further reference to our note, page 422, May 3rd, the total revenue of the Corporation tramways for the year ended December 31st, 1917, was £865,645; operating costs, £575,267; gross profit, £270,378; interest, £50,401; sinking fund charges, £52,734; reserve, renewal, and depreciation fund, £42,243; contribution to general rate account, £125,000. The net profit for the year amounted to £167,243, an increase of £21,271, as compared with 1916; traffic receipts increased by £80,435; passengers carried were 172,842,494, an increase of 15,205,899; average car earnings per car-mile 15·56d., as against 13·97d. for 1916, an increase of 1·59d. Total capital expenditure to date, including purchase money paid to the Liverpool U.T. and O. Co., £2,068,430; total sum set apart for the sinking fund and redemption of debt, £1,508,361. Since the undertaking came into the hands of the Corporation £887,032 has been placed to the credit of the reserve, renewals, and depreciation fund, and £922,899 to the relief of rates. Up to the present free military passes, value £63,412, have been granted.

**London.**—B. of T. Report.—Col. Pringle, the B. of T. Inspector, issued on May 9th the report of his inquiry into the collision between two tube trains near Warwick Avenue Station on February 25th. He finds that the collision was due primarily to the third train travelling at a speed and in a manner at variance with the company's rule on an occasion when the automatic signals were found to be at danger; and, secondarily, to the fact that the rear of the train with which it collided was not illuminated, as it should have been, by red lights. The responsibility, in the first instance, rests with the motorman Keith and conductor Cartledge; and, in the second, with conductor Watts and gateman Byrne. Col. Pringle suggests that a permanent oil tail-light should be utilised in preference to the existing electric system of tail lighting.—*Evening News.*

L.C.C. Economies.—Reporting upon the establishment by the B. of T. of a Committee to control tramways, the L.C.C. states that it has been called upon by this Committee to reduce coal consumption by 15 per cent. at least. The Committee suggests that coal

economies can be made by withdrawing services for the whole, or part, of Sundays, by stopping cars earlier in the evening, &c.

The Highways Committee recommends that, owing to the difficulty experienced in obtaining men for car washing, a limited number of women be employed in this capacity at the rate of pay of 4s. 7d. a day or night, plus 5s. a week war wages.

The revised fares on the Council's tramways will come into operation in South London to-morrow (Saturday); North of the Thames the date will be arranged later, as a number of the services are run in conjunction with those of other authorities.

**Londonderry.**—THIRD READING.—The Bill promoted by the Corporation for powers to run trolley vehicles and omnibuses, and supply electricity, &c., has been ordered for third reading; a clause has been inserted limiting the borrowing powers to £50,000 in respect of trolley-vehicles and motor-omnibuses, pending any action on the part of the Corporation to extend the city boundaries. —*Belfast News Letter.*

**Longridge.**—NEW RAILWAY.—The Light Railway Commissioners have held an inquiry into the proposal to construct a light railway from Longridge to Hellifield. The scheme is estimated to cost £210,000.

**Manchester.**—WORKMEN'S FARES.—The Electrical Trades Union, on Monday, protested strongly against the withdrawal of workmen's fares on the Corporation tramways. The Trades Council and Labour Representation Committee is to be asked to discuss means of having the fares restored and the time extended.— *Manchester Daily Despatch.*

**Nelson.**—FARE REVISION.—The Tramways Committee has decided to abolish ½d. fares, subject to the approval of the T.C.

**Ramsbottom.**—YEAR'S WORKING.—The total working expenses of the tramway undertaking for the year ended March 31st amounted to £4,158 and the income to £3,588, leaving a loss of £570.

**Sunderland.**—SUNDAY SERVICES.—The Tramways Committee recommended that, until further notice, the whole of the tramway service be discontinued on Sundays. Alderman New, chairman of the Committee, in moving the adoption of the report, said it was probably a preliminary to further curtailment. It was the opinion of the Committee that the discontinuance of Sunday traffic would not dislocate the services. Financially, Sunday was one of their best days, and the stoppage would mean a drop in the revenue of £9,400; but as the saving in wear and tear and for power would be about £5,000, there would be a net loss of about £4,400 per annum. The proposal was unanimously adopted.

**Warrington.**—TRAFFIC RESTRICTIONS.—The Sunday service on the Corporation tramways will not commence until 2 p.m. in future, and the extra late cars on Mondays and Saturdays are to be discontinued.

## TELEGRAPH AND TELEPHONE NOTES.

**Decoding Telegrams.**—To facilitate the work of decoding outgoing cable messages at the United States Censor's Office, it has been suggested that the number of the page of the code book from which the code word or cipher is taken be inserted after each word or phrase in the translated copy accompanying such messages. The proposal has met the approval of Commander A. B. Hoff, Cable Censor at New York.—*T. and T. Age.*

**Japan.**—The number of telephone instruments installed in Tokio is 45,000. The number of persons who have applied for installations is now 60,000. The authorities are of the opinion that it will be possible to satisfy every one of these applicants within ten years!—*T. and T. Age.*

**Leeds.**—At 2 o'clock to-morrow, May 18th, the 7,000 telephones operated from the Leeds Central Telephone Exchange will be transferred to the automatic system. The preparations for this change have been in progress, with slight interruptions, since October, 1914, the alterations being under the supervision of Mr. T. B. Johnstone, the superintending engineer. The changing-over will constitute a record so far as the number of instruments is concerned, and the automatic system, when in full operation, will be the largest in this country. At the hour named, the series of pegs insulating the 7,000 wires will be pulled out in groups of 50, and it is expected that in about 30 seconds the operation will have been completed.

**South Africa.**—A complete breakdown of the Durban telephone system occurred on Easter Sunday. A high-tension wire is believed to have fallen across a telephone wire or wires, and caused great damage in the basement of the exchange. There are about 3,000 lines in the basement, the greater part, if not all, of which were partially destroyed. The necessary repairs will take about a month to effect, especially as the space in the basement of the exchange is so restricted that only a limited number of men are able to work there at one time. The trunk lines as well as the local lines and fire alarms are meanwhile all out of action.

## CONTRACTS OPEN AND CLOSED.

### OPEN.

**Australia.**—MELBOURNE.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

BRISBANE.—July 1st. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary, the Treasury, Brisbane.

**Erith.**—Electricity and Tramways Department. 500-KW. rotary converter with transformers, switchgear, &c. See "Official Notices" to-day.

**London.**—ISLINGTON.—May 24th. Lighting Committee. 5,000-KW. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

**Manchester.**—May 28th. Electricity Committee. Stores for 12 months. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

**Warrington.**—May 22nd. Electricity and Tramways Committee. Motors and Transformers. See "Official Notices" May 3rd.

### CLOSED.

**Australia.**—SYDNEY.—Water Supply & Sewerage Board. Steam turbines and condensers for Ryde-Pymble pumping plant :—

| | | |
|---|---|---|
| **Willans & Robinson** .. .. .. | (accepted) | £20,267 |
| Fraser & Chalmers, Ltd. .. .. .. .. | | 19,335 |
| W. Adams & Co., Ltd. .. .. .. .. .. | | 21,336 |
| Belliss & Morcom, Ltd. .. .. .. .. .. | | 21,659 |
| Brush Electrical Engineering Co., Ltd. .. .. | | 24,049 |
| Gibson, Battle & Co., Ltd. .. .. .. .. | | 24,902 |

(Office estimate £16,000.)

—*Tenders.*

**Belfast.**—Corporation :—

General Electric Co.—Electrical accessories and M.F. lamps, 12 months.
B. I. & Helsby Cables, Ltd.—Copper fuse wires, C.I. box frames and covers, six months.
Staveley Coal & Iron Co.—Pipes, six months.
Chamberlain & Hookham.—Electricity meters, six months.—*Irish Builder.*

**Bolton.**—The Corporation has approved of the acceptance of the following tenders for supplies to March, 1919 :—

Morgan Crucible Co.—Carbon brushes.
G. P. Wall.—20's steel binding wire.
Northern Rubber Co.—India-rubber channel.
W. N. Birchby.—Coal and slack to December 31st, 1918.
R. Young & Co.—Grease, &c. (3 months).
Universal Wheel Grinding Co.—Emery wheels.

Electricity Committee :—

B. I. & Helsby Cables, Ltd.—Cables and insulated wire.
General Electric Co. — Jointing material, tape, and solution, and 15,000 ft. of casing and cover.
Credenda Conduits Co.—Steel conduits and fittings (3 months' supply).

**Bradford.**—Electricity Committee :—

Chloride Electrical Storage Co., Ltd.—Maintenance of an electric vehicle battery.
B. I. & Helsby Cables, Ltd.—Increase of 10 per cent. on existing schedule prices for cables.
Herbert Morris, Ltd.—5-ton overhead travelling crane.
J. Blakeborough & Sons, Ltd.—Circulating water valves.

**Kettering.** — Electricity Committee. Tenders recommended :—

New parts to air pump.—Rees Roturbo Co., £46.
Installation of new circulating water pipes.—Brush Electrical Engineering Co., Ltd., £425.

**Wolverhampton.** — Electricity Committee. Accepted tenders :—

Mellowes & Co.—Roof glazing for new boiler house, £266.
J. Hopkinson & Co.—Valves.
Premier Cooler Co.—Cooling towers, £4,565.
E. & S. Ham.—Cooling-tower foundations, £930; brick retaining wall in connection with switchboard extension, £100.

## FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Saturday, May 18th. At 3.15 p.m. Visit to the works of the Tottenham District Light & Heat Power Co.
Friday, May 31st. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "The Heating of Industrial Buildings," by Mr. R. Rankin.

**Institution of Electrical Engineers.**—Thursday, May 23rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Some Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant.

## NOTES.

**Volunteer Notes.**—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending May 26th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

*Captain of the Week.*—Capt. W. Darley Bentley.

*Next for Duty.*—Capt. E. G. Fleming.

Monday, May 20th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Dress, Marching Order, with rifles. Mid-day rations and tea rations to be carried.

Tuesday, May 21st.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 22nd.—No. 1 Company, Drill, Knotting and Lashing, 6.30—8.30. Recruits' Drill, 6.30.

Thursday, May 23rd.—No. 2 Company, Drill, Knotting and Lashing, 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. Band Practice, 7.

Friday, May 24th.—Musketry for the whole Corps, 5.30—8.30.

Saturday, May 25th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

**Decimal Coinage.**—The Federation of British Industries by a unanimous resolution of its Executive Council has now given its support to the Decimal Coinage Bill which is before the House of Lords. The L.C.C. Education Committee has also resolved to support the Bill.

**Electrical Power Engineers' Association.**—The Midland Section held a smoking concert on Friday last, and an enjoyable evening was spent by a large and representative gathering. The chairman, Mr. R. A. Chattock, the city electrical engineer of Birmingham, addressed the meeting, and spoke of the need for organisation among the engineers of the electrical industry. He hoped that all present would do everything in their power to make known this Association, of which he was a member, wherever possible. In speaking of the objects of the Association, he said that primarily they desired to improve the status of their members, and to better their positions, particularly with regard to the younger ones. Employers of trained engineers would have to realise that they must pay for the goods. He referred to the widespread nature of the movement, and the danger in case of duplication of organisations, of losing importance in the eyes of employers. The I.E.E. was interested in the present trend of affairs, and, with similar objects to themselves in view, desired to co-ordinate the efforts of all electrical engineers.

**Electrolytic Recovery of Tin.**—Speaking recently to the Salvage Club, Mr. David Currie, Director-General of National Salvage, said the electrolytic recovery of tin from stannate solutions was, perhaps, the most economical process to adopt at the present time, especially owing to the simplicity of the plant required, and also in view of the fact that the materials and solutions required could be readily obtained. In this process the scrap tin, after cleansing, to remove grease, &c., is charged into suitable containers and immersed in a hot caustic soda solution. Cathodes consisting of iron or copper plates are arranged in the vicinity of the containers, on which the tin is deposited in spongy form; the deposit is removed from time to time and reduced to metallic tin in a special furnace. A plant of this type, requiring about 20 kw. working continuously, is found capable of dealing with about 15 tons of scrap per week, and recovering about 3 cwt. of tin of 98 per cent. purity.—*The Engineer.*

**Water-Power Development in Canada.**—The Special Joint Water-Power Committee of the U.S. House of Representatives held another hearing on the so-called "Administration" Bill on April 15th, with Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, as the speaker.

Sir Adam Beck delivered an exhaustive analysis from his own point of view of conditions relating to water-power development in the Dominion, and the sale of hydro-electric energy in Ontario as compared with what he knew of conditions in the United States, dealing in detail with the situation at Niagara Falls. He delivered a strong plea for monopoly in public utilities. He presented a number of figures tending to show that under Government control in Toronto the rate for electricity was about half the rate at Buffalo, and made other comparisons between rates in the United States and in Ontario.

At the present time, he said, that body had contracts with 225 municipalities. They paid all interest charges at 4 per cent. and a sinking fund of 1·8 per cent., which retired in 30 years. They paid all charges of depreciation, operation, administration, &c. The chairman continued:—

"We operate at the present time 12 systems. They will become interconnected eventually and form one great system. In this way we are attaining the object of the whole scheme—namely, that there should be one control only. We want to create a real monopoly, because we believe all these service undertakings should be a monopoly. There is little satisfaction in having competition in a telephone system, or a telegraph system, or even a railway system, and certainly not in an electric system in any community. The obnoxious poles and wires, the great dual cost of everything, and the great dual investment that results because of the diversity created by these various corporations covering the same field are undesirable from every standpoint."

As to the Niagara situation, Sir Adam said the principle laid down by the International Waterways Commission was that there should be an equal division of water for power purposes on all international streams. He presented figures to show that the total power now being generated on both sides of Niagara was 653,000 h.p. Of this amount, 265,000 h.p. was generated in the United States, which also received 110,000 h.p. exported from the Canadian side, making a total of 375,000 h.p. available in the United States. This amounted to 40 per cent. more for the United States than for Canada, although the latter country generated 100,000 more horse-power than was generated in the United States. Canada was now short about 100,000 h.p. of the amount that country needed, and in order to permit a continuance of the export, Canada had arranged to do away with all sign lighting, window lighting, and other uses of energy which were not essential. The power generated by the Province of Ontario had reduced coal consumption between 5,000,000 tons and 6,000,000 tons per annum.

The estimated potential horse-power of hydro-electric energy in Canada is about 50,000,000, and in Ontario alone about 5,000,000 or 6,000,000, with but 700,000 developed. At the beginning of the Commission's work in 1910, only 750 h.p. was being delivered to the twelve municipalities interested. The Commission has acquired up to date about 86 Corporations through friendly negotiation.

**Fatalities.**—An inquest was held last Friday into the death of G. H. Aspinall, aged 22, of Stockport. Aspinall was a machine tool maker, employed by Messrs. Hans Renold, Ltd., of Burnage, Manchester, and on the previous Wednesday he was seen to put his hand to the starting box of a motor and then to fall. He was unconscious, and, though everything was done for him at the firm's ambulance room, he died soon afterwards. It was then discovered that the box was "alive," and that the cause of this was a tiny piece of steel which had got there accidentally, and had produced contact by touching one of the live terminals. It was explained that when the current was on the iron box the starter would become a powerful magnet that would attract the piece of steel, which had probably danced about until it got into contact with the live terminal, and so made the whole box alive. Evidence was given that the cause of death was heart disease. As electric shock left no sign, the doctor could not say if the man had received a shock; but if there had been a shock—as there probably was—it would have accelerated death. The jury returned a verdict of "Accidental death," and the Deputy-Coroner expressed the opinion that no one was to blame. The firm had carried out all the Government Regulations. Only a fortnight previously the box was examined, and H.M. Factory Inspector for Manchester (Mr. W. H. Seal) joined with him in the opinion that the plant at the works was of the best.

**Electric Furnaces.**—According to the *Engineer*, figures given recently by Sir Robert Hadfield show that the average actual units of electricity required per ton of steel melted are 782. This figure is based on a total of 31,850 tons of steel melted.

**Plant Growth Under Artificial Light.**—Some experiments made by Dr. C. P. Steinmetz and Mr. J. L. R. Hayden, about Christmas, 1916, on the hastening of plant growth by artificial illumination, described in the *General Electric Review*, March, 1918, are hardly encouraging for ordinary conditions. Five gas-filled Mazda lamps of 500 watts were suspended 36 in. above the ground, 17 in. apart, over a bed 5 ft. × 9 ft. The five lamps were kept burning day and night for 44 days, after which two lamps were kept on for 29 more days. The power consumed was first 2·5 kw., which averages 55 watts per sq. ft., and corresponds to an illumination of 700 lumens per sq. ft. of ground; the temperature of the hothouse, about 18° or 20° C., was raised 2° C. by the lamps. Henderson's dwarf wax-bush beans were the plants selected for the experiment. In a small check-plot, a box 36 in. square, the beans received only day light. The rate of development was nearly doubled by the artificial light and heat, but it cost a great deal to approach direct sunlight effects, as was done in this case. Some plants, flowers, and fruit, it is pointed out, temporarily command very high prices during the winter; artificial light is commercially used already for such purposes, of course.

**The Cardiff B.A. Meeting.**—Though the Cardiff meeting (1918) of the British Association for the Advancement of Science has been cancelled, the general officers hope that annual members and others will maintain their subscriptions this year, so that it may not be necessary to curtail, for lack of funds, the research work of many Committees. Some of the work is stated to be of the greatest importance in connection with circumstances arising out of the war. Subscriptions should be addressed to Prof. Perry, the General Treasurer, Burlington House, W. 1.

**Cooling Cable Ducts.**—Where cables are laid in ducts artificial cooling is possible, and in an article in the *Electrical World*, of April 20th, by W. Keating and C. H. Mueller, particulars are given of experiments with air-cooling on a section comprising ten ducts, about a mile in length, which contain eight three-phase, 11,000-volt cables, No. 0000 gauge, each carrying 200 to 220 amps. during peak loads. Above a temperature of 150° F. (65·6° C.), dielectric hysteresis causes very rapid heating which quickly leads to breakdown, and in the summer of 1916 there were 38 failures in the section referred to. The temperature of the cables approached 130° F. By installing air blowers at alternate manholes, the air escaping at the intermediate manholes, the temperature of the cables was reduced to an average of 96° F. (35·6° C.), which is just within the safe limit. Only two breakdowns, both due to station failures at other parts of the system, have occurred on this section since the blowers were installed.

In general, the authors say, 35,000 k.v.a. is the maximum load any duct line should be called upon to carry, and it is at points on the Pittsburg system, where this value has been exceeded, that trouble has developed.

**Engineering Progress in England.**—Observations upon engineering progress in Great Britain during the war were the theme of a recent informal address by Mr. H. M. Hobart, of the General Electric Co., U.S.A., at a luncheon of the Boston Section of the American Institute of Electrical Engineers, following the speaker's return from abroad. He said the British electrical industry had been split up into many more divisions than in America, and the greater portion of the small firms had aspired to manufacture many different kinds of things. Prior to the war the electrical industry in Britain was at a low ebb. Many firms found their salvation in substituting munitions and other war work for electrical machinery.

The general convulsion had brought about a serious spirit of investigation which was leading to a complete change of policy. Many new associations of manufacturers had sprung into existence, and a policy of seeking to avoid destructive competition was much in evidence.

Commenting on the national electricity supply scheme, Mr. Hobart said :—"The prevalent temper of the British is comparable to a sort of great awakening, and I venture to predict that something of this sort, or, at any rate, something thoroughly equivalent in bigness and boldness, will be 'pulled off.'"

He was much impressed with the rapid progress lately made in England in the use of built-up ironclad switchgear as contrasted with the panel and cell systems used in America. Signs were appearing of its competition with American outfits for high-voltage work in generating stations. Although the British had finally and reluctantly taken down the sign : "Business as usual," which they took pride in displaying during the early stages of the war, an enormous amount of engineering progress was being made in Britain even in these darkest of dark days.

**The Metric System.**—Speaking on "The Metric System," at a meeting of the Surveyors' Institution, Lieut. A. J. Martin, F.S.I., said that for upwards of half a century we had been abandoning or altering nearly all the measures and weights of our forefathers. In these days, and more so in the coming days, we must have up-to-date weapons of commerce or lose to an up-to-date Power, or collection of Powers, who had already made the change and gained ground ever since. Opponents of the international metric system had for many years combined against it ; but no one yet, although repeatedly challenged, had produced complete tables which surpassed the international and should replace our own. Consequently, therefore, the only alternative to remaining as we were was to adopt that system. There could, in his opinion, be no hesitation as to which course was preferable. The war presented a favourable opportunity for the change, which would otherwise become more and more difficult every year, and might come too late. A great responsibility, therefore, rested upon them at the present time. Should they have two distinct systems of measures and weights in force ? Or should they take steps to maintain and improve their position and the unity of the Empire, and even to advance the federation of mankind by adopting one language in commerce ?

An interesting discussion ensued, and one of the speakers was Mr. E. C. Barton, M.I.E.E., who said that they were continually being told that the difficulties were so great that they could not overcome them ; he thought that was a very unfortunate attitude for a great nation to take. There was not such a large majority of opponents of this proposal as one would think. A plebiscite by the Electrical Review showed that 80 per cent. were in favour of it. He had paid a visit to the North, and was surprised at the number of engineers in favour of adopting the metric system.

The President (Mr. A. L. Ryde) said he could not imagine anyone arguing that the metric system was not better than anything they had at present, and it was a mere question, to his mind, whether, and how, it could be carried out. It must be done sooner or later ; they could not compete with other nations unless they did it.

A neat and handy set of conversion tables for British and metric weights has been issued by the Hoffmann Manufacturing Co., Ltd., of Chelmsford—a companion to the linear conversion table which the firm issued some years ago. By the use of red and black figures and letters for metric and British units respectively, with one exception—evidently a slight oversight—the possibility of error is greatly reduced, and the tables are set out in a very convenient form. Copies may be had on application to the company.

**The Education Bill.**—The Executive Council of the Federation of British Industries has passed a resolution to the effect that, having regard to the apparent misconception existing in regard to the attitude of the Federation of British Industries on the Education Bill, the Council places on record its full sympathy with the objects at which the Bill aims—namely, the improvement and extension of education in this country—and will give all possible support in attaining these objects. It believes, however, that these objects cannot be attained in the fullest degree unless due provision is made for a full-time secondary education for the largest possible number of children. But before enacting any system of universal part-time education, time should be afforded to enable the employers and employed to give consideration to any peculiar needs or difficulties of particular industries and districts.

**Training Disabled Men.**—West Ham Corporation has made arrangements to hold a day course in electrical engineering for disabled sailors and soldiers. The Minister of Pensions has informed the War Pensions Committee that if the Higher Education Sub-Committee is of opinion that the expenses incurred will necessitate a fee in excess of 7s. 6d. per man per week, which is the amount normally sanctioned, he is prepared to defray out-of-pocket expenses specially incurred by the Local Education Authority during the period of six months. No special class for disabled men is to be started for less than five men, and every endeavour should be made to bring the number of men up to at least 10, which the Minister regards as the normal number of men for a class. The expenses chargeable against the Ministry are to include only out-of-pocket expenses specially incurred for the purpose of these classes—*e.g.*, extra teachers' salaries and extra cost of raw material.

The borough electrical engineer has arranged to release Mr. L. W. Perryman, a member of his staff, for six months, in order to take charge of this course ; and the Education Committee has appointed him as a teacher for the period of the course—viz., six months—at a salary of £300 per annum.

**Patents and Alien Enemies.**—Application has been made to the Board of Trade by Messrs. Bluemel Bros., Ltd., to avoid or suspend Patent No. 26,436/07 granted to Bosch for sparking plugs.

**Output of Large American Generating Systems.**—Statistics for 1917 on the outputs, peak loads, and load factors of the largest generating systems of the country are given in the *Electrical World*, Vol. 71, No. 12. The list contains every generating company in the United States and Canada having an output of more than 100,000,000 KW.-hr. per annum. The aggregate output of the companies listed was 21,000,000,000 KW.-hr., of which the companies operating in Canada generated 3,500,000,000 KW.-hr. Although the greater part of the electrical energy was generated from water power, almost all of the hydro-electric systems having steam reserve stations were obliged to use them during the year. The shortage of hydro-electric energy at Niagara is well indicated by the large output that the Buffalo General Electric Co. was called upon to turn out in its steam-driven station, where approximately 130,000,000 KW.-hr. had to be generated from coal.

Only one company in the entire list shows a slight decline in output over that of the previous year. All the others show increases, and all the Canadian companies show large increases, due chiefly to the great demand made for power by war industries.

Output and Load Factor of Generating Systems in America with Peak Loads over 100,000 KW.

| System. | 1917. | | | |
|---|---|---|---|---|
| | Peak load (KW.) | Date of peak load. | Yearly output (KW.-hr.) | Yearly load factor (per cent.) |
| Commonwealth Edison Co. .. .. | 392,330 | Dec. 28 | 1,488,060,000 | 44·6 |
| Niagara Falls Power Co.* .. .. | 152,340 | Aug. 1 | 1,188,221,770 | 88·97 |
| Ontario Power Co. of Niagara Falls | 123,500 | Nov. 11 | 990,086,100 | 91·5 |
| New York Edison Co. and United Electric Light and Power Co. .. | 278,097 | Dec. 12 | 954,913,584 | 39·2 |
| Montana Power Co. .. .. .. | 147,712 | Jan. 11 | 947,732,014 | 73 |
| Montreal Light, Heat and Power Co. | 152,665 | Nov. 12 | 946,892,817 | 70·8 |
| Hydraulic Power Co. .. .. .. | 113,665 | June 9 | 871,563,138 | 87·6 |
| Pacific Gas and Electric Co. .. .. | 158,273 | Nov. 27 | 864,099,060 | 61·6 |
| Toronto Power Co. .. .. | 118,000 | Dec. 14 | 800,638,000 | 84 |
| Southern California Edison Co. .. | 166,755 | Oct. 11 | 794,687,405 | 54·4 |
| Public Service Electric Co. .. .. | 181,500 | Nov. 27 | 784,665,649 | 46·20 |
| Detroit Edison Co. .. .. .. | 152,800 | Nov. 27 | 672,300,000 | 50·4 |
| Shawinigan Water and Power Co. .. | 119,000 | Dec. 21 | 633,573,610 | 60·4 |
| Philadelphia Electric Co. .. .. | 148,931 | Nov. 20 | 600,583,589 | 46·0 |
| Duquesne Light Co. .. .. .. | 125,000 | Nov. 9 | 592,575,925 | 54 |
| Cleveland Electric Illuminating Co. | 113,298 | Nov. 27 | 444,735,309 | 45 |

* Includes Canadian Niagara Falls Power Co.

**The World's Largest Turbine.**—The electrification of the coast section of the Chicago, Milwaukee & St. Paul Railway took a long step forward recently with the turning-over for the first time of its big turbo-generator, the largest in the world. The turbine is of 25,000-H.P. capacity, and constitutes the third unit in the White River plant, the largest and most important of the hydro-electric plants of the Puget Sound Traction, Light and Power Co. The water is fed to the turbines at a head of 465 ft. The first two turbines are of 20,000 H.P. each. The total capacity of the plant with the added unit is 65,000 H.P. This gives the traction company a combined capacity of all its plants supplying Seattle of 110,000 H.P.

The Milwaukee Road will require a little more than 50 per cent. of the additional power. The current will be delivered to the railroad at a voltage of 100,000 alternating, and transformed into direct current at a voltage of 3,000, for use on the motors of the Milwaukee electric locomotives.—*Power*, April 23rd, 1918.

**Electro-metallurgy in Sweden.**—The future and progress of electro-metallurgy in the north of Sweden are reviewed by B. Neuman in *Stahl und Eisen*, who says the industry will derive great benefit from the water powers of the country. The ores are reduced in electric furnaces, and it is estimated that the cost of an installation comprising four furnaces of 9,000 KW., is something like 1,600,000 kroner, including 400,000 kroner for housing the workmen. The annual smelting of 30,000 tons of ore necessitates the employment of 81 men, and the price of producing 1,000 kgm. of metal is between 71 and 74 kroner, the electrical energy consumed costing between 13 and 18 kroner. Transporting the metal to the interior markets costs between 78 and 79 kroner, but the price of metal smelted in blast furnaces was before the war between 70 and 75 kroner. The development of the electro-metallurgical industry in the north of Sweden is not possible until the price of the electrical energy used is lowered.—*Génie Civil*.

**London Underground Railways and Welfare Work.**—On Wednesday, last week, a Women's Club and Institute was opened by Lady Stanley at Brompton Road Station, for the female booking-office and uniform staffs of the Underground Railways. Recreation and refreshment rooms are provided, as well as a reading and rest room, and a concert hall of considerable size. The rooms are tastefully decorated, and refreshments are supplied at cost. Over 30 other institutes and mess-rooms have been provided for the service of the railway and omnibus staffs.

**Restriction upon the Use of Lead-covered Cables.**—We have received the following letter on this subject from Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A.:—

"Your issue of April 19th contains a letter by Mr. Llewellyn B. Atkinson, the secretary of the Cable-Makers' Association, drawing attention to a misunderstanding that has arisen *re* the above matter.

"The notice appearing in your issue of March 8th being certainly open to the possibility of misinterpretation, due to the abbreviated reference to the opinions of the Cable-Makers' Association and the I.M.E.A. Council respectively, I have pleasure in confirming that the contents of Mr. Atkinson's letter are in accordance with the communication originally made by the Cable-Makers' Association to my Association, and communicated *in extenso* to our members."

**Electric Welding in the Building of Ships.**—In August, 1917, Prof. Comfort A. Adams, chairman of the Standards Committee of the American Institute of Electrical Engineers, appointed a Sub-Committee to investigate the possibilities of electric welding in shipbuilding.

This Sub-Committee was adopted in September last by the General Engineering Committee of the Council of National Defence, and later (February 21st of this year) by the Emergency Fleet Corporation, as its Electric Welding Committee.

The Emergency Fleet Corporation has authorised the construction of a 50-ft. (15.2-m.) section of a 9,600-ton standard ship at the yards of the Federal Shipbuilding Co., Newark, for demonstration purposes and for the development of methods of applying electric welding to an actual ship structure. This ship section is to be sealed up at the ends, filled with water, and tested by hydrostatic pressure. The foundation for this structure is already complete, and work will be pushed on as rapidly as possible. Both spot and arc welding are to be employed. Shipbuilders have indicated that they are willing to push the work just as far as the Classification Societies, the Fleet Corporation, and the Navy Department will allow.

Large stationary and portable spot welders are being designed for this work, and various arc-welding systems are being studied. A considerable installation will be made in the Hog Island yard at Philadelphia, under the general direction of Admiral Bowles, of the Fleet Corporation.

Mr. H. M. Hobart, chairman of the original Sub-Committee, spent several months in England investigating the electric welding work done by the British Admiralty, and brought back some valuable data. As a result of this visit, Captain James Caldwell, R.E., representing the British Admiralty, is spending a couple of months here to help the Committee in this work and to tell of the work along similar lines which has been carried out in England. One important phase of the present work of the Committee is the training of arc welders, of whom thousands will probably be required in the comparatively near future.—*Electrical World.*

**Electrical Men Aid Prisoners of War.**—In view of recent events on the Western Front, few of the funds being raised in connection with the war have a more urgent claim upon our attention and practical generosity than those existing for the purposes of sending parcels to our men who are prisoners in the hands of the enemy. The first large effort that has been made by electrical men to aid such funds has been made by the Bristol and Cardiff electrical and engineering trades. The effort has been crowned with splendid success, and we regret that war-time pressure upon our limited space prevents us from giving the event that full publicity which it deserves. The crowning effort in connection with the scheme, which was to raise funds for our prisoners of war (through the Bristol Red Cross Society) and the Bristol Inquiry Bureau, took place last Saturday evening. With Mr. H. I. Rogers as president, a Committee, combining all the influential electrical men in Bristol, founded a scheme by which it has raised about £600 for the funds. On the previous evening (Friday) a whist drive and a dance were held at the Grand Hotel, and both were successful, thanks to Mr. A. C. Wiley (chairman of the Committee), Mr. Weeks, Mr. Glass, Mr. Porter, Mr. Hood, and Mr. Pedlar, who formed the Special Committee for this particular scheme. The prizes were presented by Mr. Dowson, Mr. A. Davis (Morgan Crucible Co.), Mr. W. J. Longhurst (Veritys, Ltd.), and Mr. W. G. Heath. On the following day, on the Bristol City Football Ground, two excellent teams, selected by the Bristol and Cardiff Committees, played a football match before a crowd of 8,000 spectators, in glorious weather. The Bristol boys won by 2 goals to 1.

The city ground was kindly lent for the occasion by the directors, and their chairman (Mr. Murdock) rendered valuable assistance. Mr. W. J. Wedlock captained the Bristol team. Players from Everton, Birmingham, Wolverhampton, and Barnsley being in the vicinity of Bristol, volunteered their services, and the Cardiff team included T. J. Hewitt, the Welsh international, as "skipper." The band of the Royal Engineers was there. The Lord Mayor of Bristol, together with the Lady Mayoress, the High Sheriff and the Lady Sheriff, patronised the match, and the ball (presented by Messrs. Harris's Sports Department), was set rolling by the Lord Mayor. At half-time the Lord Mayor sold the ball by auction twice, and the sum of £23 2s. was realised. The ball has since been again re-sold for 10 guineas. A barrel of cider, kindly presented by Mr. J. H. Winter, was put up for auction at the dinner after the match, and sold by the Lord Mayor for 37 guineas. Mr. W. J. Longhurst, as the knight of the whistle, refereed the game in a very able manner. The linesmen were two G.E.C. men, Mr. A. H. Smith (Cardiff) and Mr. W. L. Richards (Bristol). Much of the success of the scheme is due to a Committee of ladies from the Bristol Corporation and electrical houses, with Mrs. Cyril Nutt as chairwoman and Miss Michell as secretary. The following chairmen acted over various Sub-Committees:—Mr. Longhurst, Mr. Weeks, Mr. Dowson, Mr. Royce; and Mr. A. J. Newman (Bristol Corporation) superintended the gate stewards at the ground. Mr. A. C. Wiley acted as chairman of the various Committees. Mr. A. H. Dowson presented cigarettes for the wounded soldiers who were present, and was the hon. treasurer of the movement. Mr. Ernest Cooke (Simplex Conduits) was the hon. secretary.

**Appointments Vacant.**—Electric lighting attendant, for oil-driven generating station in the Curragh District; junior shift engineer (£156), for the Barnsley Corporation Electricity Department; teacher of day classes in electric wiremen's work, for the Wolverhampton Education Committee; assistant shift engineer (68s. 3d.) for the Bury Corporation Electricity Department; meter superintendent for the Loughborough Corporation Electricity Department; charge engineer for the Dover Corporation Electricity Department. See our advertisement pages to-day.

**Large Single-Phase Transformers.**—Four of the largest single-phase transformers ever built were recently shipped by the Westinghouse Electric and Manufacturing Co. to a Southern power company. These units are rated at 14,000 K.V.A., 60 cycles, and, since they have a 25 per cent. overload rating, they have practically a 17,500-K.V.A. maximum capacity. They will form a 42,000-K.V.A. bank, which, together with a spare unit, will make the preliminary installation to step up the voltage of the water-wheel-driven generators from 13,200 to 150,000, the highest transmission voltage used to-day. Power will be transmitted about 25 miles to an industrial plant, where it will be stepped down by means of a number of 7,000-K.V.A. single-phase transformers of similar characteristics built by the Westinghouse Co.

Some idea of the size of these units may be gained from the fact that their height measures 23 ft. 6 in. from the top of the high-tension terminals to the base, and each unit weighs, complete with oil and fittings, approximately 110,000 lb.—*Power*, April 23rd, 1918.

**Track Construction Methods Employed in Street Widening.**—In the *Electric Railway Journal* of March 30th, an account is given of the methods employed in track construction during the widening of Twelfth Street, one of the principal thoroughfares of Chicago. The taking up of two well-laid tracks set in concrete construction, moving them more than 20 ft., and placing one of them along what was formerly the front end of a store basement, was the part taken by the Chicago Surface Lines Co.

The street was widened from 66 ft. to 108 ft., and the work involved the building anew of 1·38 miles of double track, including seven special work lay-outs, and the rebuilding of 300 ft. of double track on either side of the street at each one of these seven intersections, on account of the change in grade. In all, over 3 miles of single track was built in a short space of time, and a number of labour-saving devices were employed, as the paving contractors were working under a time penalty clause.

The foundation for the concrete slab for the east-bound track was first laid and completed all the way through before the old tracks were disturbed. East-bound traffic was then operated over the new track, leaving the former east-bound track free for the use of work and material cars. As the sub-grade construction work for the new west-bound tracks progressed the rails of the old east-bound track were moved, in good condition, over on to the new ties and foundation. Finally, upon the completion of the second track, west-bound car service was transferred to this, and the old west-bound track was torn up and removed.

The type of track construction used is the standard 2—A Board of Supervising Engineers' Construction for use in paved streets, except in some cases, where it differs on account of the uncertain character of the foundation, placed as it was over a new fill some 9 ft. deep.

When the new east-bound track was completed for traffic work was commenced on the new west-bound track, and this is interesting because of the fact that the rails of the old east-bound track were moved over and used on the new track without separating the electrically-welded joints. All work on the sub-foundation was, therefore, completed for a section, and gangs of men following the mixers freed the rails of the old track from their fastenings, and they were then pried over. This was done by gangs of men using crowbars to gradually pry the rail over to its new position, this being done quite satisfactorily without breaking any of the Lorain-welded joints. When the rail was in its new location, another gang of men cleaned the rail to receive the new concrete and grouting.

The work of tearing up the old paving outside the rails in order to free the rails was greatly expedited by placing jacks underneath two or three tie rods at a time, after the inside paving had been removed. Lifting up on the jacks bent the rods up and pulled the rails towards each other and away from the outside paving, thus avoiding the necessity of removing the first row or two of blocks by hand.

**Institution of Electrical Engineers.**—At the meeting of the Institution, on Thursday last week, the President, Mr. Wordingham, announced that the Council, in conjunction with the B.E.A.M.A., had appointed a Committee on the lines suggested by Mr. W. A. Gillott, to deal with the subject of electric cooking and heating. Similar action had been taken as the outcome of Mr. L. Andrews's paper, in association with the B.E.A.M.A., the C.M.A., Chambers of Commerce, the Federation of British Industries, and the British Engineers' Association, with a view to calling a conference to discuss whether any action could be taken that was likely to further export trade. A Committee had also been appointed, as suggested by Mr. E. C. McKinnon, to draw up a model agreement for the maintenance of storage batteries, and the Council was communicating with the British Engineering Standards Committee with regard to the standardisation of the details of batteries. An Electrical Appointments Board was in course of formation; under the Articles of Association this could not be done by the Institution, but a separate body would be set up for that express purpose, acting in conjunction with the Institution.

**Breach of Lighting Regulations.**—At York, last week, Major P. Davidson, R.F.C., was fined £1—the Bench considering a technical offence had been committed—for causing electrical energy to be consumed in the auditorium of the Albany Hall, Goodramgate, during prohibited hours, the occasion being a dance in aid of the local Red Cross funds. The light was being used half an hour later than was permitted by the Board of Trade licence.

**Metal Commandeering in the States.**—A Reuter's dispatch states that the U.S. Government has commandeered all the platinum, palladium, and iridium held by refiners, jewellers, dealers, and some importers at a price of $105 per troy ounce.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station and Tramway Officials.**—MR. GEORGE A. NEWSOME, A.M.I.C.E., manager of the Burgh and County Tramways, Dumbarton, has been appointed manager of the Darwen Corporation Tramways.

The municipal electrical engineer at Durban (Mr. John Roberts) has, for health reasons, tendered his resignation to the Corporation. Mr. Roberts has held the position for the last 20 years.

Plymouth Electricity Committee has increased the salary of the engineer (MR. E. G. OKELL) by £50 per annum (£650 to £700).

The Dartford U.D.C. has increased the salary of MR. J. D. PEMBER, electrical engineer, from £310 to £350 a year.

MR. CHUBB, assistant engineer at the Maidenhead electricity works, has resigned to take up an appointment at Stoke-on-Trent.

The Torquay T.C. has advanced the salary of MR. KEENAN, acting electrical engineer, from £180 a year to £230, plus the special bonus of £63 per annum, Mr. Keenan foregoing the 12½ per cent. award under the Munitions of War Act, 1916.

The proposed increases of salaries in the Bradford tramway department, subject to payment for any work by officials for Government or other authorities being made to the Corporation, are as follows, including bonus:—

Mr. C. J. Spencer, general manager, increase £200, to £1,000; Mr. J. W. Dawson, electrical engineering assistant, by £50 to £375; Mr. T. Stirk, traffic superintendent, by £50 to £350; Mr. W. K. Fleming, parcel department superintendent, by £40 to £298; Mr. T. B. Moseley, chief clerk, by £25 to £298; Mr. T. Sykes, technical assistant, by 22s. 2d. to 114s. 8d. per week; Mr. S. Pearson, works superintendent, by 19s. 3d. to 114s. 8d.; Mr. J. W. Foster, permanent-way engineer, by £30 per annum to £300; Mr. H. S. Sharp, assistant engineers' department, by 2s. per week to 73s. 6d.

At the Swansea Corporation electricity department, on Friday last, MR. B. BEYNON, charge engineer, was presented with a clock and ornaments, on the occasion of his marriage. The presentation was made by the borough electrical engineer (Mr. J. W. Burr).

MR. P. PRIESTLEY, manager of the Oldham Corporation tramways, who was recently appointed deputy manager of the Liverpool Corporation tramways, was presented, last week, with a cabinet of cutlery from the employés of the Oldham tramway department.

**General.**—MAJOR ARTHUR WATSON, who has been superintendent of the line on the Lancashire and Yorkshire Railway for several years, is now appointed also assistant general manager.

The *Times* states that it has been decided by the Congress of the General Association of French Posts and Telegraphs that M. PREVOST should represent the Association at the British Postal and Telegraphic Congress to be held next month.

The staff of the General Electric Co., Ltd. (Glasgow Branch) met, last Friday evening, to celebrate the semi-jubilee of MR. P. J. SIMS, manager for Scotland. A most successful concert was held in the handsome new building of the firm at 71, Waterloo Street, just completed since the outbreak of war. The presentation—which took the form of an 18-carat gold watch and a mahogany clock with a sapphire, pearl, and diamond pendant for Mrs. Sims—was made by Mr. A. G. Bell, a member of the staff, who has been associated with Mr. Sims almost since the beginning of his connection with the firm. Mr. Jas. Wink, manager of the Aberdeen subbranch, acted as chairman, and was supported by representatives from the English branches and leading engineering and manufacturing firms in the country.

**Roll of Honour.**—The Military Medal has been awarded to SERGEANT A. WOOLLEY, of Stone (an employé of Messrs. Siemens Bros. Dynamo Works, Stafford), for gallantry in action. When his battery was subjected to a hurricane bombardment he showed an utter disregard for personal safety. On another occasion he worked assiduously in helping to extinguish an ammunition dump fire.

PRIVATE FRED FALLOWS, L.N.L. Regiment, who was employed at a Bolton Corporation electricity sub-station, has been killed in action, aged 19 years.

PRIVATE GEORGE MACDONALD, who was engaged on the Burnley Corporation tramways, has been awarded the Military Medal.

PRIVATE E. BRADBURY, Duke of Wellington's Regiment, wounded in action, was employed at the Bradford Corporation electricity works.

PRIVATE T. WHITAKER, Northumberland Fusiliers, who has been awarded the Belgian Croix de Guerre, was formerly on the staff of the Leeds City Electricity Department.

FLIGHT-COMMANDER CAPTAIN E. D. HALL, R.A.F., who has been awarded the French Croix de Guerre, was electrical engineer at Brandon Collieries when he joined the Forces.

PRIVATE H. S. HOLDSWORTH, Manchester Regiment, posted missing in September last, and now reported killed, was employed by Messrs. Charles Macintosh, Ltd., Manchester.

RIFLEMAN H. WILSON, K.R.R., reported missing since March 24th, was on the Coventry Corporation electricity department staff.

SERGEANT-MAJOR STANLEY PARKER, K.O. Yorkshire L.I., who was an electrician at Ackton Hall Colliery, Featherstone, has been killed in action.

LANCE-CORPORAL A. G. SCOTT, who was on the staff of the Ilford U.D.C. electricity works, has fallen in action.

GUNNER C. R. LIDDELL, R.F.A., who was before the war a draughtsman with Messrs. Cowans, Sheldon & Co., of Carlisle, has been killed whilst repairing a telephone line near the position of his battery.

RIFLEMAN J. ROSE, Royal Irish Rifles, who has been missing since March 21st, was employed by Messrs. John Collier & Sons, electricians, of Manchester.

LANCE-CORPORAL F. GIFFORD, R.E., who has died of wounds, was employed by Mr. Jabez Smith, electrical engineer, of Faversham.

LANCE-CORPORAL C. F. BAKES, West Riding Regiment, who is reported missing since March 21st, was employed by the Phœnix Dynamo Manufacturing Co., Ltd.

CAPT. G. L. ANDREWS, R.G.A., whose death in action is reported, qualified, according to a Sheffield paper, as an electrical engineer at the Brush Co.'s Works, Loughborough, and afterwards held positions under the tramway authorities of Kidderminster, Madrid, Hull, Sunderland, and Lisbon, and as manager of the Para Electric Railways and Lighting Co. and of the Pernambuco Tramways and Power Co. He was a member of the Institutions of Civil, Mechanical, and Electrical Engineers.

SECOND LIEUT. W. PARR-DUDLEY, who was killed in action on April 5th (aged 19), went to Faraday House Electrical Engineering College two years ago with a scholarship, and, according to the *Times*, he won the Silver Medal there at the end of his first year. He joined the Forces in May last year.

SECOND LIEUT. E. F. S. HAYTER, R.F.A., who was killed in action on March 21st (aged 26), was born in Australia, and was educated in Melbourne as an electrical engineer. He was connected with the electrical signalling work of the Victoria State Railways until he came to England, two years ago, to join the Forces.

ACTING-SERGEANT WM. GEIPEL was killed on May 4th at the Curragh, Ireland, while flying. Only on the morning of the same day he was recommended for a commission in the R.A.F., being recognised as a "pilot far above the average," and possessing the qualifications of leadership and command essential for an officer. The deceased was a nephew of Mr. Wm. Guy-Pell (Wm. Geipel and Co.). Previous to joining the Forces he was a student at the Armstrong College, Newcastle, and was an apprentice electrical engineer at Messrs. Richardsons, Westgarth's works at Hartlepool.

RIFLEMAN C. H. LONG, K.R.R., an apprentice at the Chichester electricity works, was killed in France, aged 18 years.

PRIVATE W. H. GREEN, Somerset Light Infantry, who is posted missing, was employed by the St. Helens Cable and Rubber Co.

CORPORAL E. LESLIE, S. Lancashire Regiment, who has been killed in an explosion on the railway, was employed in the electricity department of the Warrington Corporation.

PRIVATE T. WHITAKER, who was formerly employed at the Whitehall Road works of the Leeds Electricity Department, has been awarded the Belgian Croix de Guerre.

PRIVATE J. FOSTER, who has been wounded in action, was formerly employed at the Kirkstall Road depôt of the Leeds Corporation tramways.

**Obituary.**—MR. CHARLES S. GARNETT, manager of the Darwen Corporation electricity works, died from pneumonia on Sunday morning, aged 40 years. He had only been ill a week.

MR. CHARLES CYRUS HOWARD, formerly tramway manager for the Bolton Corporation, has died at the age of 59 years. He retired from active service in 1906, and had been ill for some years past.

The *Times* "Deaths" column contains notification that there passed away on May 11th, at Cleveland, Ohio, after protracted illness, CHARLES SKRINE POWELL, who was on the staff of the Westinghouse Co. in London from 1902 till 1905.

## NEW COMPANIES REGISTERED.

**Electrical Components, Ltd.** (150,218).—Private company. Registered April 20th. Capital, £5,000 in £1 shares. Manufacturers of and dealers in electrical accessories, motor-car fittings, &c. The subscribers (each with one share) are:—W. T. Bower, 184, Jockey Road, Sutton Coldfield, electrical engineer; R. W. Bill, 19, Whitehall Road, Handsworth, electrical engineer. The first directors are: W. T. Bower (manager and secretary) and R. W. Bill. Registered office: 36, Cannon Street, Birmingham.

**Tampico Electric Light and Power and Traction, Ltd.**—Particulars of £500,000 debenture stock created December 27th, 1917, secured by trust deed dated April 16th, 1918, filed pursuant to Section 93 (3) on the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Benefit of concessions and contracts for undertakings connected with Tampico, Mexico, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Major the Hon. Weetman H. M. Pearson, and Sir Maurice Bonham Carter, K.C.B.

**Associated Brass and Copper Manufacturers of Great** Britain, Ltd. (150,375).—Private company. Registered May 7th. Capital, £50,000 in £1 shares. Manufacturers and factors of copper, brass, metals, and alloys, and plant, fittings, and articles manufactured wholly or partly therefrom, and to acquire any existing business or rights in connection therewith, provided that (until the restriction is relaxed by extraordinary resolution) the business to be established, acquired, or carried on by the company shall be limited to soliciting and obtaining orders from and export to China (including the Republic of China, Hong-Kong, and any parts of China proper which have passed, or may pass, into the possession of any other Power). The subscribers (each with one share) are:—Sir Gerald A. Muntz, Bart., Tiddington House, Stratford-on-Avon; E. C. Clark, Norwood, Ellesmere Park, Eccles, metal manufacturer. The first directors are: C. J. R. Bedford, Birmingham; E. C. Clark, Manchester; J. W. Earle, Birmingham; K. Fraser, Leeds; W. W. Gibbins, Birmingham; E. Mapplebeck, Birmingham; Sir Gerald A. Muntz, Bart., Birmingham; and A. W. Wolseley, Birmingham. Qualification, 500 shares, or being a director or nominee of a company holding that number of shares. Remuneration as fixed by the company. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

**Alloy Welding Process, Ltd.** (150,396).—Private company. Registered May 9th. Capital, £120,000 in £1 shares (20,000 cum. pref.). To enter into agreements (1) with the Russo-British Finance Co., Ltd., and (2) with E. J. Jones, to acquire certain inventions relating to improvements in electric blow-pipe and other forms of welding and soldering, and to carry on the business of engineers, manufacturers of and dealers in motor cycles, &c. The subscribers (each with one share) are:—W. H. Mugford, 1, Strathearn Road, S.W. 19, solicitor's clerk; C. H. Brookes, 3, Worcester Gardens, S.W. 11, solicitor's clerk. The first directors are: E. H. Jones (managing director), W. A. Hunter, and F. W. Poyner. Remuneration according to profits. Solicitors: Spyer & Sons, Austin Friars House, E.C. 2.

**Quain Electric Co., Ltd.** (150,401).—Private company. Registered May 9th. Capital, £20,000 in 10,000 cum. pref. and 10,000 ord. shares of £1 each. To enter into an agreement with the Russo-British Finance Co., Ltd., to acquire certain patents relating to improvements in electric heaters and radiators, and to carry on the business of electricians and electrical engineers, &c. The subscribers (each with one share) are:—W. H. Mugford, 1, Strathearn Road, S.W. 19, solicitor's clerk; C. H. Brookes, 3, Worcester Gardens, S.W. 11, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Spyer & Sons, Austin Friars House, E.C.

**Batteries, Ltd.** (150,403).—Private company. Registered May 10th. Capital, £100,000 in £1 shares. To acquire from the Svenska Ackumulator Aktiebolaget Jungner (incorporated in Sweden) all or any part of its patent and similar rights, &c., for the United Kingdom and British Empire in relation to the manufacture of storage batteries or other apparatus, &c. The subscribers (each with one share) are:—W. L. W. Brodie, 4, Regent Street, S.W., solicitor; W. H. Bonham-Carter, 4, Regent Street, S.W., solicitor; P. J. Dobinson, 4, Regent Street, S.W., clerk; W. T. C. Bennett, 4, Regent Street, S.W., clerk. The first directors are: W. L. W. Brodie and W. H. Bonham-Carter. Registered office: 19, Coleman Street, E.C.

**Phœnix Armature Works, Ltd.** (150,299).—Private company. Registered April 27th. Capital, £2,000 in £1 shares. To take over the business of armature winders and repairers carried on by H. A. Parkes at 455A, Stockport Road, Manchester, as the Phœnix Armature Works, also to carry on the business of repairers and renewers of the windings of electrical generators, motors, and machinery, &c. The subscribers (each with one share) are:—H. A. Parkes, 72, Stockport Road, Manchester, mechanic; W. L. Worledge, 62, Wellington Road, Oldham, electrical engineer; E. King, 19, Lucerne Avenue, Werneth, Oldham, electrical engineer. The first directors are: H. A. Parkes, W. L. Worledge, and E. King. Qualification, £100. Solicitors: Howard, Laycock & Co., 33, Princess Street, Manchester.

**Parkinson Motors, Ltd.** (150,330).—Private company. Registered May 1st. Capital, £25,000 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in dynamos, motors, machines, meters, lamps, burners, wire, and accumulators, and all articles and implements used for supplying light and power. The subscribers (each with one share) are:—F. Parkinson, Greenlaw, Guiseley, engineer; A. Parkinson, 2, Eldor Mount, Guiseley, engineer. The first directors are: F. Parkinson and A. Parkinson (both permanent). Solicitor: G. C. Thompson, 5, Bank Street, Bradford.

**J. H. Nott & Sons, Ltd.** (150,365).—Private company. Registered May 4th. Capital, £10,000 in £1 shares (3,000 pref. and 7,000 ord.). To acquire the business formerly carried on by the late John Henry Nott as J. H. Nott & Sons, at Vincent Lodge, Swansea, and elsewhere, and to carry on the business of lighting, heating, sanitary, mechanical, electrical, and general engineers, plumbers, electricians, ironfounders, manufacturers of and dealers in gas engines, motor cars, &c. The subscribers (each with one share) are:—G. Nott, Overton, Glanmon Road, Swansea, electrical engineer; W. D. Hughes, 70, Sketty Road, Swansea, secretary to Swansea Hospital. The first directors are: G. Nott and W. D. Hughes. Solicitor: E. Davies, 4, Goat Street, Swansea.

**Wigan Electro-Metallurgical Works, Ltd.** (150,320).—Private company. Registered April 30th. Capital, £50,000 in £1 shares. To acquire from W. B. Hamilton, H. A. Blackwell, and W. L. Turner their interests in an invention relating to grey cast iron, and to carry on the business of ironmasters, manufacturers of pig iron, white iron, grey iron, and electro pig iron from scrap or ore, steel makers and converters, manufacturers of metallic alloys, &c. The subscribers (each with one share) are:—H. A. Blackwell, Whyte House, Bispham, Blackpool, metal merchant and mine owner; W. L. Turner, Purley, Calday, Ches., company director; W. B. Hamilton, 32, Grosvenor Road, Birkdale, metallurgical chemist; A. W. Blackwell, Sparlands, Argyle Road, Southport, metal merchant; Geo. G. Blackwell and Sons, Ltd., 46, The Albany, Liverpool; Blackwell's Metallurgical Works, Ltd., 46, The Albany, Liverpool; British Thermit Co., Ltd., 49-51, The Albany, Liverpool; E. S. Blackwell, Rossett, Bankfield Lane, Southport, metal merchant. The first directors are: H. A. Blackwell and W. L. Turner (governing directors), each of whom may retain office while holding 15,000 shares. Qualification of ordinary directors, 500 shares.

**J. E. & S. Spencer, Ltd.** (150,316).—Private company. Capital, £10,000 in £1 shares. To take over the business carried on at 16, Dowgate Hill, E.C., as J. E. & S. Spencer, and to carry on the business of iron merchants, engineers, metal agents, metal-tube manufacturers, electricians, &c. Agreement with S. Spencer, Sir Ernest Spencer, H. Spencer Smallman, and T. H. Spencer. The subscribers (each with one share) are:—S. Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; Sir Ernest Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; T. H. Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; H. Spencer Smallman, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent. The first directors are: S. Spencer, Sir Ernest Spencer, T. H. Spencer, and H. Spencer Smallman. Qualification, 1,000 shares. Registered office: 16, Dowgate Hill, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Aluminium Corporation, Ltd.**—Three mortgages dated April 15th, 1918, to secure £500, £575, and £1,100, charged on lands in Carnarvon. Holders: (a) R. S. Chamberlain and Lucy G. Chamberlain, (b) W. M. Jones and R. V. Johnson, (c) Mary and Ellen Davies.

**Brazil, Straker & Co., Ltd.**—Temporary charge on the company's undertaking and property, present and future, including uncalled capital, dated April 13th, 1918, to secure £25,000 already advanced, and further advances up to £50,000. Holder: F. C. Yeo.

**Worthington Pump and Machinery Corporation** (1,659F).—Particulars filed April 24th, 1918. Registered in Virginia, U.S.A., April 20th, 1916. Objects: To acquire certain properties formerly owned by the International Steam Pump Co. (incorporated in New Jersey), and to carry on the business of mechanical, electrical, and general engineers, &c. Capital stock, 36,000,000 dols. in shares of 100 dols. each. British address: Queen's House, Kingsway, W.C., where E. W. Husted is authorised to accept service.

**Manganese Bronze and Brass Co., Ltd.**—Memorandum of satisfaction in full on March 25th, 1918, of charge dated December 1st, 1917, to secure £6,500, has been filed.

**Mica and Micanite Supplies, Ltd.**—Mortgage dated April 17th, 1918, to secure £1,400, charged on leasehold premises at Islington. Holder: A. G. Weeden.

**Brilliant Arc Lamp & Engineering Co., Ltd.**—Memorandum of satisfaction in full (a) on May 14th, 1917, of charge dated May 28th, 1917, securing fluctuating amount, and (b) on February 7th, 1918, of charge dated April 26th, 1917, securing fluctuating amount.

**Baxendale Bros., Ltd.**—Third debenture, dated January 16th, 1918, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. P. Vine, Bath.

**A. Vernon-Ward (Hove), Ltd.**—Notice of the appointment of A. Rosenberg, of 259, High Holborn, W.C., as receiver and manager on April 25th, 1918, under powers contained in debenture dated March 26th, 1918, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

**Maxim Lamp Works, Ltd.**—Agreement to issue debentures, charged on certain leaseholds and trust deed for £4,000, dated March 21st, 1918. Debentures to be charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. F. Poynter.

**Robert Bowran & Co., Ltd.**—Mortgage for £2,000, dated May 1st, 1918, charged on freehold land and buildings at Pelaw, Durham. Holder: J. Blaney, Sunderland.

**Acousticons, Ltd.**—J. P. Clarkson, of 16-17, Devonshire Square, E.C., ceased to act as receiver or manager on April 30th, 1918.

**Hill Bros. (Magnetos), Ltd.**—Equitable charge on properties at Bedminster, Bristol, to secure all moneys due or to become due from company to National Provincial & Union Bank of England.

**Burgess Hill & District Electric Supply Co., Ltd.** (85,698).—Capital £6,000 in £1 shares (3,000 pref.). Return dated March 19th, 1918. All shares taken up. £5,900 paid; £100 considered as paid. Mortgages and charges: £1,200.

**British L. M. Ericsson Manufacturing Co., Ltd.** (79,061).—Capital, £200,000 in 99,990 pref. and 100,010 ord. shares of £1 each. Return dated March 28th, 1918. All shares taken up. £1 per share called up on 50,010 ord. and 99,990 pref, and 8s. per share on 50,000 ord.; £170,000 paid; £30,000 considered as paid, being 12s. per share on 50,000 ord. Mortgages and charges: £50,000.

**County of Durham Electrical Power Distribution Co.,** Ltd. (61,591).—Capital, £425,000 in £1 shares. Return dated March 26th, 1918. 400,000 shares taken up. £400,000 paid. Mortgages and charges: £250,000.

## CITY NOTES.

**Babcock and Wilcox, Ltd.**

Net profit for 1917, subject to excess profits duty, £444,513, plus £56,495 brought forward. After paying the preference dividends and 9 per cent. on the ordinary shares, free of income-tax, £150,000 is put to reserve fund, £10,000 to the staff pensions fund, and £77,056 remains to be carried forward, subject to excess profits duty. The works are fully occupied to the extent of the labour available. The total holding in War Loan and Bonds is £928,945. Paying the ordinary dividend free of income tax is equivalent to an increase in yield. Owing to the machinery being operated by unskilled labour, and the impossibility, due to the shortage of skilled labour, of keeping it in the usual state of repair, it has been considered necessary to provide for the exceptional wear and tear of same. In the Sociedad Espanola de Construcciones Babcock & Wilcox which has been formed, this company has a considerable interest, and it will be under the

company's technical management. Two directors—Messrs. Knight and Kemnal—have been appointed directors of the Spanish company. This new enterprise has been approved by the British authorities. The whole of the capital of 20 million pesetas has been subscribed in Spain and by this company. Mr. F. G. Bourne has retired from the board. In his place Mr. E. H. Wells, president of the Babcock & Wilcox Co., New York, has been elected a director.

**The French Thomson-Houston Co.**

It was recently mentioned in this journal that the Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston had decided to increase its share capital in two stages from £2,400,000 to £3,600,000 and £4,800,000 respectively. The reasons which have led to this development were explained in a special report presented at a recent extraordinary general meeting, and in the course of a speech delivered by the chairman on that occasion, which is of interest beyond the borders of France, M. Charles Laurent stated that the directors had endeavoured to develop the company's means of production in the course of recent years; they had extended the works and improved the machinery and plant, and had recruited a numerous personnel not only to repair the large gaps which the mobilisation had caused in the ranks, but also to improve the efficiency. Since May, 1916, the company had made a large issue of bonds in order to satisfy the growing requirements, and had acquired in the vicinity of Paris a vast site for the erection of workshops. But all this was inadequate for the purpose. It was necessary to proceed further if it was desired not only to conserve for the company the important position which it occupies in the electrical industry, but also to render it able to participate in the intense business activity which was expected as soon as Europe or the whole world returned to a peaceful life, and at the same time permit it victoriously to contend with foreign competition. It was possible to use two methods for the accomplishment of this object. The first was for the company to continue with its individual resources the expansive effort which had been commenced, and the second was to ascertain whether it was not possible to unite with a similar undertaking which all at once could furnish all the new forces desired. Although the difficulties which would have attended the execution of the former plan would have been considerable under existing conditions, the directors doubtless would have been induced to propose it had not a favourable opportunity presented itself for attaining the object in view by means of an understanding with the directors of an undertaking with which they had not ceased to maintain friendly relations, namely, the Eclairage Electrique. Certain of the manufactures produced by the latter, the chairman remarked, were similar to those made by the Thomson-Houston Co., whilst others were complementary thereto. The Compagnie Francaise Thomson-Houston was to absorb the Eclairage Electrique by the issue to the latter of new shares in the former for nominally £1,200,000, and the Eclairage Electrique would be liquidated for this purpose. The works would be taken over in full activity with the staff of experienced men, a numerous body of customers, and the personal co-operation of the directors, to whom the rapid rise of that company was due. The principle of the amalgamation having once been agreed to, the chairman stated that a second augmentation of £1,200,000 in the share capital was a natural corollary, as a developing undertaking needed a considerably larger working capital for the supply of the workshops and for current working requirements. The existing proprietors would have a preferential right of subscription to the second issue of £1,200,000, and the new shares would be available for a period extending three months after the conclusion of Peace, so as to allow those who under present circumstances might be unable to take up the shares for various reasons, a future opportunity of exercising their right in this direction.

**German Companies.**

The directors of the *Lloyd Dynamo werke A.G., of Bremen*, state that after allocating £11,000 to depreciation in 1917, as against £6,500 in the previous year, the accounts show net profits of £7,300, as compared with £2,400. It is proposed to distribute 7 per cent., this contrasting with no dividend in 1916.

The financial statement of the *Nord-Deutsche Seekabel Werke A.G., of Nordenham*, whose share capital of £300,000 is jointly held by the Felten & Guilleaume Co. and the German Atlantic Telegraph Co., indicates net profits of £14,000 for 1917, as against £1,400 in 1916, the sum of £9,000 and £8,000 respectively having previously been written off for depreciation. A dividend of 4 per cent. is recommended, being the same rate as in 1916.

The accounts of the *Elektrochemische Werke, of Berlin*, whose shares, amounting to £350,000, are entirely held by the Zurich Bank for Electrical Undertakings, show net profits of £109,000 for 1917, as compared with £73,000 in the previous year. It is intended to pay a dividend of 15 per cent., as against 12 per cent. in 1916. The company only carries on, apart from war installations, an oxalic acid factory, the main works at Bitterfeld and Rheinfelden being leased to the Griesheim Elektron Chemical Co.

The report of *Voigt & Haeffner A.G., of Frankfort-on-Main*, states that all departments were occupied to the limit of their capacity in 1917, and the value of the turnover more than doubled, the new factory rendering good services in this respect. As gross profits the accounts show the sum of £270,000, as compared with £169,000 in the preceding year. After defraying general expenses and setting aside £34,000 for depreciation, as contrasted with £14,000, the net profits are returned at £170,000, as against £102,000 in 1916. The directors recommend a dividend at the rate of 12 per cent. on the share capital of £250,000, being the same rate as in each of the two previous years. A bonus of £5 in War Loan and £1 10s. in cash per share are also to be distributed, making a total of 25 per cent. for the year. The report states that a reduction in the deliveries for war account may be reckoned with in the new financial year, but that favourable activity is foreseen for the company's regular manufactures.

The report of the *Bergmann Elektrizitats Werke A.G., of Berlin*, states that the works were increasingly engaged on war contracts in 1917, which necessitated the taking up of new manufactures. A substantial augmentation in the turnover took place, and about one-half of the volume of business applied to the delivery of munitions, and one-half to the company's regular products. The system of co-operation practised in connection with Government electrical works had already led to large orders, which were in course of execution. Special attention was devoted to the cultivation of trade with neutral countries in so far as this was permitted by the State, release of raw materials, and the grant of export licences. The gross profits amount to £1,079,000, as compared with £958,000 in 1916. After meeting general expenses, interest charges on the loans, taxes, &c., and placing £253,000 to depreciation, as against £316,000 in 1916, the accounts exhibit net profits of £573,000, as compared with £459,000. The dividend is at the rate of 12 per cent. on share capital of £2,387,000, this contrasting with 10 per cent. in 1916, 10 per cent. in 1915, and 5 per cent. each in 1914 and 1913.

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**The Swedish Elektra Works.**—The directors of the A. B. Elektra Verken report net profits of £39,000 for 1917. After making provision for the renewals and reserve funds, they recommend the payment of a dividend of 10 per cent. on the ordinary share capital of £164,000. In order to liquidate the debt of £660,000 shown in the balance sheet as being due to the Allmänna Svenska, of Vastoras, for the purchase of factories in the latter place for the production of cooking and heating apparatus and installation material, and in order to extend the company's activity, it is proposed to increase the share capital to £274,000. It is mentioned in this connection that soon after its formation the Svenska Elektra Verken acquired the Stockholm glow-lamp factory, the Svenska Elektra battery factory, and the Svenska Thermos flask factory, these acquisitions giving the company the majority control over the Tungsten Wire Works, A.B.

**British Ever-Ready Co., Ltd.**—The report to March, 1918, shows that the amount available for appropriation, after writing off depreciation, charging £2,500 to general reserve, and after making reserve for the purpose of providing for excess profits duties, income-tax, and contingencies, amounts to £34,683. Final dividends of 10 per cent. are paid on the preference and ordinary shares, making 10 per cent. for the year, plus a bonus of 7½ per cent. in the case of the ordinary shares, making their total 17½ per cent., leaving £6,058 to be carried forward. The directors are carefully considering the conditions that may be expected to prevail after the war, and what steps are necessary to place the company in a position to take the best advantage of those conditions.

**France.**—An extraordinary general meeting of the Compagnie des Cables Télégraphiques, held in Paris on April 30th, approved an increase in the share capital from £537,000 to £640,000, so as to permit the company to participate to the extent of £100,000 in the formation of the new company termed the Compagnie Générale de Télégraphie sans Fil. This decision has been taken in agreement with the Ministry of Commerce, who authorised the company temporarily to transfer the amount from the prevision fund pending repayment from the proceeds of the capital augmentation.

**Western Union Telegraph Co.**—The annual report shows that in 1917 the gross operating revenue was 77 million dollars, and operating expenses were 63 millions, leaving 14 millions surplus, making with 1½ millions for loans, &c., a total of 15½ millions. After deducting interest on bonds and amounts transferred to reserves, there remained a balance of 11½ millions to be added to the surplus of 24½ millions from 1916. Dividends absorbed 7 millions, leaving a surplus of 29 millions. The dividend was at the rate of 7 per cent.

**Great Northern Telegraph Co., Ltd. (of Denmark).**—At the general meeting to be held on June 29th, the directors will propose for the year 1917 the distribution of a total dividend and bonus of 22 per cent., including the 5 per cent. already paid, and to set aside the following amounts, viz.:—£55,556 to the reserve and renewal fund, £11,111 to the pension fund, and £111,111 to extraordinary taxes.

**British Insulated & Helsby Cables, Ltd.**—The scheme for reorganisation of the capital by capitalising £500,000 of the reserves, and issuing it in the form of ordinary shares fully paid, is to be submitted at an extraordinary general meeting on May 27th. Each ordinary shareholder will receive one share for every one now held by him.

**Minehead Electric Supply Co., Ltd.**—The war restrictions reduced the units sold for lighting during 1917, and there was a considerable increase in cost of fuel, in wages, and repairs. There was a satisfactory increase in units sold for power. Profit on trading, after paying debenture interest, £906, plus £31 brought forward. After paying the preference dividend, and 5 per cent., less tax, on the ordinary, £316 is put to depreciation and reserve, and £39 is carried forward.

**Calcutta Electric Supply Corporation, Ltd.**—Final dividend on ordinary shares for the half-year ended December 31st, 1917, 6¼ per cent. actual, making 10 per cent. for the year.

**Nairobi Electric Power & Lighting Co., Ltd.**—Final dividend of 4 per cent., making 10 per cent. for the year, less income tax.

**Craigpark Electric Cable Co., Ltd.**—The annual meeting was held in Glasgow on Monday, Dr. MAGNUS MACLEAN presiding. The report was adopted.

**Edison & Swan Electric Co., Ltd.**—A petition for confirming the reduction of capital from £888,071 to £698,307 has been presented to the Court.

**Anglo-Portuguese Telephone Co., Ltd.**—Final dividend of 3 per cent., less tax, for 1917.

**Chloride Electrical Storage Co., Ltd.**—Dividend on ordinary shares 10 per cent., free of tax.

## STOCKS AND SHARES.

TUESDAY EVENING.

THE confident tone of the Stock Exchange markets is well maintained. No news from the Front is read as good news—no news, that is to say, of the beginning of another German offensive. Domestic politics have quieted down, but the subscriptions to the National War Bonds are not regarded with satisfaction. At the same time, considerable uncertainty remains over financial matters generally, in consequence of the man-power proposals, and until something more definite emerges from the obscurity, so long is it bound to be the case that men of the new military age will conserve their assets in as liquid a form as possible, and make whatever arrangements they regard as necessary to meet the prospect of having to live upon capital if they are called up.

Prices in most markets are better. A noticeable recovery has taken place amongst home railway stocks, although the Undergrounds, as usual, are somewhat slow in responding to the lead set by steam stocks. The best market is that for Underground Electric issues, where London Electric ordinary have risen 15s. to 2½, and the Underground income bonds at 77 are 2 to the good. There has been vague talk of some re-arrangement being made in regard to the interest payable on the latter bonds, but nothing official has transpired, and in the market it is not considered likely that alterations will be made, at any rate for the present. The Tubes are likely to be benefited rather than the reverse from the drastic revision of fares now proposed. Judged by present conditions, there is more traffic than trains. To come up to town in a first-class smoking compartment with eight people sitting down and 26 standing up, while advertisement counsels the taking of a season-ticket "for comfort and room to breathe," should be more consoling to the proprietor of the company's bonds than to the traveller on the company's lines. District 6 per cent. debenture stock has risen to 101¼, and the 4 per cent. debenture gained a point at 67½. Metropolitan Railway prior-charge stocks have strengthened, although the ordinary has eased off.

Mexican issues make a better showing. The various favourable factors to which attention has been drawn here during the past two months are combining to bring in a few bold purchasers. The railway stocks of the country are better, and Utilities, although showing few quotable changes, make a much better market than they have done of late. It looks as though prices might improve further, and that it would be wrong to sell now. British Columbia Electric stocks keep good, holding the full extent of the substantial rises which we recorded last week; the preferred and deferred show further advances. Anglo-Argentine Tramways 4 per cent. debenture has hardened to 69, and the 5 per cent. to 64, while the first preference are 1/16 better.

Tax-free stocks in the telegraph market keep steady. The Eastern group has hardened. Eastern ordinary is 3 up. Globes are not easy to buy. In other cable issues, the market remains hard without showing noticeable changes. Marconis have stiffened, and with the parent shares has come improvement in one or two of the subsidiaries. Americans, for instance, are 23s. 6d., Canadians 9s. 9d., and Spanish changed hands the other day at 9s. Anglo-Portuguese Telephone ordinary were done at 18s. 3d. this week; the debenture stock has gone back a couple of points to 94½.

London Electric Supply preference have hardened to 31, and this constitutes the only change in the list of supply companies' shares. A good deal of activity stirs amongst the manufacturing descriptions. General Electric ordinary are a good market at 20½ bid. Edisons have recovered to 32s. after their dip to 24s. Brush ordinary is quoted at the nominal price of 40 to 45, but there are buyers about at the top figure of 45, and they might even give more. British Westinghouse preference are conspicuously flat at 2 1/16 ex the 3s. dividend. The chairman's speech at the recent meeting has probably a good deal to do with the sales that have depressed the price, but it may be that too much pessimism has been read into his remarks. Electric Constructions are a better market at 23s. 9d. upwards. Babcock & Wilcox, in the engineering division, rallied to 3¾ on the declaration of a final dividend making 15 per cent., free of tax, for the year. Henley's are 10s. higher at 19½.

London United Tramways debenture has weakened to 38. Tenders are being invited by the respective companies for London and Suburban "A" debenture, and Metropolitan Tramways 4½ per cent. debenture. A guide to stockholders who may desire to tender is afforded by the market quotations, which are 77-80 for the London and Suburban, and 69-72 for the Metropolitan stocks. Business has revived to some extent in Victoria Falls & Power descriptions, the second debentures rising to 107, the ordinary and preference being 18s. and 23s respectively. Rubber shares continue to show a weak tendency. Iron and steel issues are firmer. Base-metal shares are mostly on the up-grade.

### SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

| | Dividend 1916. | Dividend 1917. | Price May 14, 1918. | Rise or fall this week. | Yield p.c. |
|---|---|---|---|---|---|
| Brompton Ordinary | 9 | 10 | 47 | — | £7 6 0 |
| Charing Cross Ordinary | 5 | 4 | 8½ | — | 6 3 1 |
| do. do. do. 4½ Pref. | 4½ | 4½ | 3½ | — | 6 18 6 |
| Chelsea | 3 | 3 | 3 | — | 8 6 8 |
| City of London | 8 | 8 | 12 | — | 6 10 8 |
| do. do. 6 per cent. Pref. | 6 | 6 | 9½ | — | 6 0 4 |
| County of London | 7 | 7 | 10⅝ | — | 6 13 4 |
| do. 6 per cent. Pref. | 6 | 6 | 9½ | — | 6 0 4 |
| Kensington Ordinary | 6 | 7 | 5⅝ | — | 6 10 8 |
| London Electric | Nil | Nil | 1¼ | — | Nil |
| do. do. 6 per cent. Pref. | 4 | 5 | 3½ | + ¼ | 7 18 10 |
| Metropolitan | 3 | 4 | 3½ | — | 6 8 1 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 3½ | — | 6 13 4 |
| St. James' and Pall Mall | 8 | 9 | 7 | — | 6 8 4 |
| South London | 5 | 5 | 3⅞ | — | 7 3 4 |
| South Metropolitan Pref. | 7 | 7 | 21/- | — | 6 13 4 |
| Westminster Ordinary | 7 | 8 | 6½ | — | 7 3 10 |

TELEGRAPHS AND TELEPHONES.

| | Dividend 1915. | Dividend 1916. | | | |
|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. | 6 | 6 | 94 | + ½ | £6 7 8 |
| do. Def. | 88/8 | 14 | 22½ | — | 6 14 10 |
| Chile Telephone | 5 | 5 | 7⅞ | + ½ | 6 6 6 |
| Cuba Sub. Ord. | 5 | 7 | 9½xd | — | *7 7 4 |
| Eastern Extension | 8 | 8 | 12xd | — | *6 6 8 |
| Eastern Tel. Ord. | 8 | 8 | 153½xd | +3 | *6 4 8 |
| Globe Tel. and T. Ord. | 7 | 7 | 14⅜ | — | *4 17 5 |
| do. Pref. | 6 | 6 | 9⅞ | + ½ | 6 1 6 |
| Great Northern Tel. | 22 | 24 | 30s | — | 6 11 8 |
| Indo-European | 13 | 13 | 46½xd | — | 6 14 0 |
| Marconi | 10 | 15 | 3½ | — | 4 17 10 |
| Oriental Telephone Ord. | 10 | 10 | 4½ | — | 2 7 0 |
| United R. Plate Tel. | 8 | 8 | 7 | — | *5 15 4 |
| West India and Pan. | 6d. | 6d. | 1½ | — | *3 6 8 |
| Western Telegraph | 7 | 8 | 15½ | — | *5 4 1 |

HOME RAILS.

| | | | | | |
|---|---|---|---|---|---|
| Central London, Ord. Assented | 4 | 4 | 6½ | — | £6 8 0 |
| Metropolitan | 1 | 1 | 20½ | — | 4 16 5 |
| do. District | Nil | Nil | 14 | — | Nil |
| Underground Electric Ordinary | Nil | Nil | 1½ | — | Nil |
| do. do. "A" | Nil | Nil | 4/6 | — | Nil |
| do. do. Income | 6 | 4 | 77 | +2 | *5 4 0 |

FOREIGN TRAMS, &c.

| | Dividend 1915. | Dividend 1916. | | | |
|---|---|---|---|---|---|
| Adelaide Sup. 6 per cent. Pref. | 6 | 6 | 87 | — | £6 6 4 |
| Anglo-Arg. Trams, First Pref. | 5½ | 5½ | 2⅞ | + 1/8 | — |
| do. 2nd Pref. | 5½ | — | 2⅜ | — | — |
| do. 5 Deb. | 5 | 5 | 64 | +1 | £7 16 4 |
| Brazil Tractions | 4 | 4 | 68 | — | — |
| Bombay Electric Pref. | 6 | 6 | 94 | — | 6 6 4 |
| British Columbia Elec. Ry. Pfds. | 5 | 5 | 58½ | — | £8 11 0 |
| do. do. Preferred | Nil | Nil | 40½ | +2 | Nil |
| do. do. Deferred | Nil | Nil | 34 | +1 | Nil |
| do. do. Deb. | 4½ | 4½ | 65 | — | £6 15 0 |
| Mexico Trams 5 per cent. Bonds | Nil | Nil | 97½ | — | M-1 |
| do. 6 per cent. Bonds | Nil | Nil | 80 | — | Nil |
| Mexican Light Common | Nil | Nil | 17½ | — | Nil |
| do. Pref. | Nil | Nil | 29½ | — | Nil |
| do. 1st Bonds | Nil | Nil | 88½ | −2 | — |

MANUFACTURING COMPANIES.

| | | | | | |
|---|---|---|---|---|---|
| Babcock & Wilcox | 15 | 15 | 31 | + 1/8 | £4 8 8 |
| British Aluminium Ord. | 7 | 10 | 13/- | — | £6 8 6 |
| British Insulated Ord. | 17½ | 20 | 8½ | — | £5 10 4 |
| British Westinghouse Pref. | 7½ | 7½ | 2 1/16xd | — 1/8 | £7 5 3 |
| Callenders | 20 | 20 | 17 | — | £5 17 8 |
| do. 5 Pref. | 5 | 5 | 4 | — | £6 5 0 |
| Castner-Kellner | 22 | 20 | 31/9 | — 2/6 | £5 17 4 |
| Edison Swan, fully paid | — | — | 2½ | — | Nil |
| do. do. 4 per cent. Deb. | 4 | 4 | 75½ | — | £5 6 — |
| Electric Construction | 7½ | 7½ | 1/- | + 1/8 | £6 6 4 |
| Gen. Elec. Pref. | 6 | 6 | 10½ | — | £5 15 8 |
| do. Ord. | 10 | 10 | 20½ | — | £4 18 9 |
| Henley | 25 | 25 | 19½ | — | £6 6 7 |
| do. 4½ Pref. | 4½ | 4½ | 8½ | — | £5 13 2 |
| India-Rubber | 10 | 10 | 18½ | — | *£6 8 6 |
| Telegraph Con. | 20 | 20 | 42 | — | *£5 19 0 |

* Dividends paid free of income-tax.

## DIESEL ENGINES AND TAR OIL.

At a meeting of the Diesel Engine Users' Association held on March 21st, Mr. J. E. Edgecombe read notes on tar-oil running with a four-cycle, four-cylinder, horizontal, 400-B.H.P. engine driving a 20-ton flywheel-type alternator, with an output of 270 kw. at 2,100 volts, single-phase. In a 120-hour run the tar oil used was 6 tons 11 cwt., ignition oil 9 cwt., percentage of ignition oil to tar oil, 6.87 per cent., and units generated 14,771. The consumption figure of combined tar oil and ignition oil worked out at 1.07 lb. per unit generated. Crude petroleum was used mostly for ignition oil, but kerosene had given satisfactory results. Average blast pressure was 750 lb., at no time rising to 800 lb. Gas oil had been used for ignition purposes, and it was found equally as satisfactory as either crude oil or kerosene. It was his practice to change over to fuel oil before shutting down, and also to start up on fuel oil. On one occasion the engine was shut down on tar oil, and no difficulty was experienced in starting up again on tar oil. When overhauled the flame plates and pulverisers on all four lines were found in excellent condition, and showed no traces of choking up.

Mr. J. M. Ferguson said the various devices were in their experimental stage, and at the present time pilot ignition formed the only reliable arrangement, and one which gave a greater latitude in the quantity of tar oil which might be used satisfactorily. The case for pilot ignition had not been quite fairly stated, for no mention was made that *tar oil* might be used for ignition purposes down to about half-load, thereby reducing the quantity of crude oil required to a much lower figure, depending on load conditions. A further point which required attention was the improvement which resulted from warming the tar oil.

Mr. H. S. Russell said the chief point put up against the ignition pump system was that a larger proportion of petroleum oil was required than with other systems. The only answer to this must be that the system had proved satisfactory wherever it had been adopted, and sufficient experience of the other systems had not been obtained to say that they solved the problem. Insurance companies were unwilling to take increased risks of breakdown, especially at the present time, and their objection to experimenting with systems which could not be said to have proved satisfactory could be understood. The various means by which engines could be adapted to tar-oil running without the use of ignition pumps all seemed to be objectionable from the point of view of the risk to the engine.

Mr. G. Neville Huntley, referring to ignition temperatures, said it was important to distinguish between the temperature of explosive ignition given by Mr. Moore's apparatus and the ordinary temperature at which oil caught fire at the surface when heated in an open cup. There was no necessary relation between the ordinary ignition point and the figures given by Mr. Moore's apparatus.

Mr. P. A. Holliday, after giving particulars of experiments which led up to the adoption of pilot-ignition, briefly described the gear as now fitted to a four-cylinder, 220-B.H.P. Diesel engine of their own build. Two fuel cam noses are fitted side by side, one for giving the valve "pilot injection," and the other being the main admission cam. Two independent rollers are fitted into the fuel-valve operating levers, the one engaging with the main cam being mounted on a concentric pin, whilst the other is mounted on an eccentric portion of the same pin. These pins are linked up to a main shaft connected to the governor, so that the clearance between the pilot cam and its roller varies according to the load on the engine; thus for full load it has the maximum, and for no load the minimum clearance. By this arrangement the fuel valve opening by the pilot cam is earliest on light load, and gradually becomes later until maximum load is reached. It is, therefore, possible to work with a good advance for no-load, and all the maximum pressures are reasonable. When starting or stopping on petroleum the gear is fixed, so that the engine only operates off the main fuel cam. The gear is very sure in its action, as shown by cards taken with the gear in and also out of operation. No pistons have ever been drawn, the exhaust valves remain normal, and the pulverisers, which are of usual standard design, do not require cleaning under 200 hours' run. Cooling water temperatures and blast pressures are normal.

Mr. C. O. Milton mentioned the peculiar behaviour of a four-cylinder, 320 B.H.P. Corlis engine fitted only with coned flame plates, and the original pulverisers of the ordinary type. This engine would run without any trouble down to one-tenth of full load, while generally engines would not run steadily on tar-oil at less than half-load without the provision of more elaborate devices. It was found practicable to cut out a cylinder without upsetting the regular running of the engine. It was most important to note that a cylinder should never be cut in or out while the engine was on tar oil. It should first be put over on to fuel oil, the change in the number of working cylinders then made, after which it could be put back on to tar oil. He found that outside certain limits a difference in temperature of the cooling water of 15 deg. would make an appreciable difference to the running of an engine. An engine required very much closer attention when running on tar oil; even fuel distribution was much more important than with petroleum fuel. At Maidenhead needle valves kept tight and gave no trouble, but they were the despair of everybody connected with them. An examination showed that the points of opening of the fuel valves were much earlier than usual, and this, together with the fact that the needles had worn down a recess into their seats, practically produced the same results as the new gear Mr. Holliday had described was intended to do. All sorts of difficulties seemed to be due mainly to variation, without any notice, in the quality of the oil supplied. The most important factor in the final solution of tar-oil running would be suitable and close specification of the oil.

Mr. H. Moore said that after tests with some 40 tar oils he had come to the conclusion that the entire problem of ignition trouble was one of temperature, and, apart from the use of ignition gear, it was therefore mainly dependent on compression. The main difference between petroleum oils and tar oils was one of ignition point. Ignition temperatures of petroleum oils were generally below 300 deg. C., while in the case of tar oils they were in the region of 500 deg. C. He had tested samples of tar oils which had been specially prepared, and found them to possess ignition points below 350 deg. C. Vertical-retort tar oils were slightly lower in ignition point than horizontal-retort tar oils. In order to obtain good working and starting from "cold" on tar oils without ignition oil, and certainty of ignition with all tar oils, it was necessary to employ a compression pressure of 650 to 700 lb. per sq. in. This necessitated higher blast pressures and increased stresses to a very serious extent. With the above pressures the wear on exhaust valves was no greater than with petroleum oil, but uncertainty of ignition and increased stress were very detrimental to them. Pulveriser choking was generally encountered when burning oils rich in naphthalene, but it need not prove to be a serious trouble, and would be overcome by modification of pulveriser design. Most members appeared to have had little difficulty with mixing oils; he had, however, known many cases of deposition of a solid india-rubber-like substance as the result of mixing tar oils with petroleum.

Mr. P. H. Smith said the most vitally important requirement, irrespective of running conditions or system applied to burn tar oil, was the pre-heating of the oil to about 80 deg. F. and feeding it to the engine at about this temperature. Regarding the Controller's aim, it was of the utmost importance to convert as large a number of Diesel engines as possible to burn tar oil in the shortest possible time, and prospective users of tar oil would therefore be well advised at the moment not to insist on refinements unessential to their ordinary loading conditions. The loading range must be extended, and minor difficulties overcome in both the national and Diesel users' interests. He disagreed with the previous speaker that compression pressures of the order of 650 to 700 lb. were necessary to burn tar oil without pilot ignition. The average pressures employed for any system appeared to be between 450 and 500 lb.

Mr. G. B. Vickers said his firm were pinning their faith on obtaining the best possible atomisation of the fuel. The main idea to obtain this complete atomisation seemed to be to offer as many sharp edges as possible where the blast air could impinge on the tar oil, splitting it up, as it tended to coalesce in passing through the flame-plate orifice. He thought too much stress should not be laid on running engines satisfactorily down to no-load; it was not advisable to do so, and these were not normal conditions.

Mr. Ernest T. Williams said it was important that engines burning tar oil should run satisfactorily, even at the lowest load, as there were instances, where no storage battery was used, in which engines had to run for considerable periods on low loads. The subject appeared to be of such importance that a small grant to enable an expert to devote a portion of his time to the subject would appear to be desirable.

## A BRITISH ELECTRICAL PROVING HOUSE.

At a meeting of the Institution of Electrical Engineers last week this subject was discussed. An abstract of the paper by Mr. C. Turnbull appeared in our last issue.

Mr. C. H. Wordingham, President, said he would make a few remarks before the discussion opened as to the attitude of the Council on this subject, and what he said would be on behalf of the Council of the I.E.E. as well as on his own. It was some 20 years ago that he first suggested a similar scheme himself, but nothing came of it; he again brought up the question about four years ago, when the war commenced. The first thing to be remembered was that if, as was suggested, a new body was set up it must not overlap or commence doing on its own what others had been and were doing already. The suggested proving house should carry out tests only, it should not cover research work; and, further, it should not formulate rules nor make specifications. When these were, as they could be, made by the competent authorities, then the work of the proving house would be to see that they were properly carried out. Such a body as suggested would have to be compact, and not spread over a wide area, so that it should not overlap other bodies who were doing, and were more competent to do, the same work. The work of the proving house would consist of testing and

examining goods, and when such goods conformed to its requirements, attaching its hall-mark thereto. This hall-mark should be attached only to Imperial goods and articles, and it would prove that such goods were made within the Empire, and that they had attained a high standard. He used the word Imperial rather than British because he had been misunderstood lately when he used the word British; it had been thought that he meant England and Scotland only when he said British, whereas he really meant Imperial. As to the governing body of the suggested proving house, there should be a preponderance of commercial representatives on the board, makers would also be largely represented, but not to such an extent as the commercial element, and, of course, users would also be represented on it. The National Physical Laboratory was governed by the Royal Society; it had lately carried out a large amount of commercial work and tests, and an advisory council of commercial men had now been formed. He was convinced that the proving house should be an offshoot of the National Physical Laboratory, and subject to the latter's board of control. A sub-board could be formed to govern the proving house, on which there should be three representatives of the I.E.E., including the President, six from the B.E.A.M.A., two from the Cable Makers' Association, two from the I.M.E.A., two representing insurance, one shipping interests, &c., and this sub-board would be under the control of the governing body of the N.P.L.

Mr. H. H. Berry pointed out that in the U.S.A. they already had such an organisation as the proposed proving house. He referred to the National Board of Underwriters, which had established a code of its own, but this code went beyond the scope of the present paper. By this code they had in the U.S.A. not only fixed standards, but also types, and in Canada British goods were thrown out, not because they did not conform to the standards of the code; the goods were not faulty, but they were of a different type, and they were rejected on the score of interchangeability. This Board of Underwriters had taken most elaborate precautions respecting fire risks, but it did not consider life risks to the same extent. Goods that conformed to the requirements of this code were quite safe regarding fire risk, but many of them would not be tolerated by British engineers on account of the life risks they involved. Speaking from a manufacturer's point of view, he said that, apart from the financial standpoint, manufacturers would have a great deal to gain from, and they would welcome, such a proving house; they had suffered in the past from the lack of just such an institution. A proving house such as suggested would have to work in conjunction with the National Physical Laboratory.

Mr. Roger T. Smith agreed with what the President had said; apparently the author, as set forth in his paper, wished the proving house to overlap the N.P.L., and other such bodies which carried out research work, and, further, that it should teach the Engineering Standards Committee its work. He disagreed entirely with these views. With regard to duties, the proving house should carry out tests only, and the preparation of specifications should be left to the Engineering Standards Committee. Further, the drawing up of new and improved rules should be left to bodies competent to deal with the subject; these were not matters for the proving house. Research should also be left to bodies which were intended to carry out research, and the work of the proving house would consist of carrying out any tests which it was asked to carry out. The question of cables and rubber could not be dealt with by the proving house, this would have to be left to an entirely separate body.

Capt. Wm. P. Digby said that a great deal would be learned from the results obtained by the work of a proving house, which should only deal with Imperial products, and the hall-mark should only be affixed to such products, although foreign goods could be examined as well with a view to finding out if there was anything that could be learned from them. An important point was that each of our Colonies should be represented by a local man on the governing committee of the proving house. Such a representative would keep the committee informed as to local conditions and difficulties by correspondence, and he would furnish information as to what was really required in his own particular locality. Speaking on the requirements of the American code, he said that all goods should pass a life test; it was not much use if an article conformed to requirements for a time only, it must have a reasonably long life if it was to be of any value.

Mr. Charles P. Sparks said that, speaking as the chairman of the Wiring Rules Committee, he entirely agreed with and welcomed the views put forward by the President. In this country they had been working away for years, but there was weakness because there was always a missing link in the chain, and he thought this proposed proving house would prove to be that missing link. There were enormous financial difficulties in the way of the scheme as put forward in the paper. The National Physical Laboratory was already in existence, it was at hand, and could go right ahead at once if the views and suggestions put forward by the President were adopted; he looked upon these views as something definite and constructive.

Mr. Ashley said that, in a way, he was there to represent the Board of Trade, but he came mainly to learn something. The Board of Trade attached great importance to the questions of interchangeability and standardisation; it considered that the proposed proving house would considerably help British industries both at home and abroad. The hall-mark of such an institution would carry great weight, and would afford help to inexperienced purchasers, as they would then be sure that goods so stamped were reliable. The scheme should have very careful and detailed consideration; the I.E.E. and the Engineering Standards Committee should be represented on the governing body of the proving house; its hall-mark must be affixed to goods quite independently of trade advice, and it must be entirely free from private influence if it was to attain international importance.

Mr. A. R. Everest said that the difficulty of the manufacturer was to know what he had to do. There were so many rules and regulations in force at the present time that the manufacturer was quite at a loss as to which of these he must follow. He quite agreed with the President's suggestions; construction should be left to the Engineering Standards Committee, and methods of installation to the I.E.E. When these bodies had collected, co-ordinated and issued particulars, then the work of the national proving house would be to certify and see that the rules were correctly carried out.

Mr. W. R. Rawlings said that all contractors would welcome the propositions put forward by the President, and he hoped they would meet with better success than those made on similar lines by the President some years ago in Manchester. Such a scheme would be welcomed by contractors, and more so by the public. Fire insurance companies only considered fire risks, and municipal authorities did not care so long as they could sell sufficient energy. An important point was that a proving house must have power to enforce its requirements, otherwise it would find itself in the same position as the Wiring Rules Committee stood to-day. If it were possible to obtain Home Office enforcement of the wiring rules, then they would be an excellent set of rules.

Mr. Wm. R. Cooper said he was glad to hear that the I.E.E. Council did not favour the proving house overlapping the National Physical Laboratory, and also that it was not proposed that it should carry out research work. The question of materials did not matter so much, it was the finished article that was important, and this was the work for the proving house, to see that the finished article conformed to requirements. The life of an article could not be stated beforehand unless the conditions under which it was to work were definitely known. It was difficult to give guarantees to cables because the exact conditions under which they were to work could not be known, and he therefore did not think the proving house could deal with such things as cables.

Mr. C. le Maistre said that he personally agreed with the Council's proposal. It was difficult to certify large numbers of articles, and he recommended the Engineering Standards Committee's system of sanctioning the use of its brand as *prima facie* evidence that the article complied with the standards specified. The Committee was now incorporated, and owned the brand. It was bringing into existence a number of affiliated committees in 12 or 14 engineering centres abroad; the Canadian Committee was an extremely strong one, and so was that of the Indian Government. South Africa was another important centre. The Committees were being formed with the help of the new department of the Board of Trade and the Foreign Office, and would ultimately be of immense value to British Trade abroad.

Mr. H. W. Clothier said that the proving house would naturally be the body to find out the necessity for inventions as the result of meeting with troubles of all kinds, but it should not be the authority to study troubles as well as affixing the hall-mark on British productions. He was one of those who did not take a gloomy view of the amount of research work that had been done in this country in the past. The author pointed to the number of research establishments in the U.S.A.; here we had a large number of small works and the requisite amount of initiative, and we could do what the Americans had done. The proving house would be a means of co-operation; he thought British manufacturers were working well together at present, and they were beginning to co-operate. The proving house would be a commercial authority, and it must not, therefore, be controlled by a scientific body. The whole scheme depended largely on the co-operation of insurance companies.

Dr. Richard T. Glazebrook said he was glad to hear that the proving house was to be joined in some way with the N.P.L.; the proving house should not do the research work, but it must certainly be in direct contact with some institution which did carry out the research work. He thought that senior members of the control boards of both the N.P.L. and the proving house should be in contact, so that they could work together without overlapping; and, further, that foreign goods should be reported on by the proving house. A good illustration of how the N.P.L. worked was in connection with aviation. When something new was required aviators stated what they needed, and the N.P.L. was left to find out what could be done, and how.

Mr. G. Scott Ram said that the question of specifications would be one of the first difficulties, as there were no specifications made for such things as fuses, &c. He thought the proving house should test the design as well as the material of all articles. In recent times the use of composite materials was coming to the fore, and it was very desirable that such materials as these should be tested.

Mr. D. N. Dunlop said he was glad to see the I.E.E. was beginning to take interest in commercial matters; however, he would not say much on that question, as no doubt both

sides were to blame for what had occurred in the past. With regard to the present scheme, he thought that co-operation would be easy enough, but who was going to finance the scheme? The Government would not pay, and in the U.S.A. they had a stamp system by which the money was eventually got out of the consumer. He thought that the proving house should at first commence with small articles, and gradually build up. He did not see why foreign goods should not be examined as well as British goods; there was no reason for not affixing the hall-mark to foreign goods providing they were examined, and had proved that they conformed to the requirements of the national proving house.

Mr. J. F. Pearce said that the principles advocated were generally conceded, and the association of the proving house with the National Physical Laboratory had one outstanding advantage—the independent position of the Laboratory. There were, however, disadvantages in this connection, which the speaker detailed, emphasising the importance of the maintenance of standards by the Laboratory, and urging that functions so different as those of the Laboratory and the proving house should be independently performed.

Mr. C. Turnbull, in reply, said that apparently most speakers were in favour of some such scheme as he suggested in his paper, Mr. Roger Smith being the only speaker who criticised it in any way. He hoped the scheme would be carefully thought over, and that the work of setting up such a proving house would be commenced with as little delay as possible.

## ELECTRICAL COOKING AS APPLIED TO LARGE KITCHENS.

At a meeting of the Manchester Local Section of the Institution of Electrical Engineers, Mr. W. A. Gillott's paper was read and discussed on December 11th, 1917.

Mr. Bertram Thomas said that if electrical cooking were generally adopted so as to affect station plant and the distribution of energy, the tariffs would have to be readjusted. In many cases the load came on the peak, and was not altogether a desirable load for a central station. Efficiency need never be sacrificed to reliability. Usually the trouble had been that the apparatus had not been well designed, and had been rated too high. Difficulty was now being experienced with supports; mica used as a support by itself was not very satisfactory, as it would not stand a high temperature. Most of the failures had been due to terminals, leading-in wires, or supports. He did not think there was really any reason why the wire itself should fail if it were properly rated. No large up-to-date kitchen could be established unless low-pressure steam was provided. It did not seem a practical proposition at the present time to use electricity for heating large quantities of water. The washing-up ought to be carried out in a separate department, and it was necessary to wash up by steam if it was to be done effectively. A motor-driven steam-heated washing machine was the only practical way. The author appeared to favour self-contained vessels, but it would be found that everybody wanted to use their own vessels, and did not wish to install new ones. Careful comparative tests indicated that as between gas and electric cooking there was very little difference in the loss of weight of meat; it was about 3 per cent. in favour of electricity. By the use of the thermometer, cooking could be made almost an exact science; that must lead to economy both in electricity and in food.

Mr. A. E. Jepson said that one of the speakers in the discussion before the Institution suggested that more attention should be paid to high-voltage apparatus, say for 400 or 500 volts. There were difficulties in the way. The insulation of most of the insulators used, such as mica, enamel, and ceramic ware, decreased enormously as the temperature rose. He had known the insulation of a hot-plate to decrease from 40 megohms when cold to 1,000 ohms at 400 deg. C.; while a slab of quartz changed from 95 megohms at 486 deg. F. to 0.17 megohm at 1,013 deg. F. In order to make water-boiling a commercial proposition for large quantities, where the cost of generating electrical energy was low, say, 0.22d. to 0.28d., and if electrical power could be obtained for water-boiling at such a figure, with a properly lagged boiler having a low consumption there would be practically no heat lost; an extra heater could then soon bring the water up to boiling point when required. Station engineers might quote a special figure for units consumed during the night, when water-heating might be carried on. He endorsed Mr. Thomas's remarks about the economy of cooking by electricity.

Mr. R. Weaving was pleased to note that the author placed reliability first, as the absence of breakdown was more important than the consumption of a few more units. Most of the breakdowns in the past had been due to wiring faults and troubles between terminals and element wires. The large apparatus described in the paper could be designed to allow of strip connections not less than ¾ in. wide being brought out direct to terminals on porcelain supports in the bottom of the oven. Wrought-iron clamps scaled badly with heat, and eventually became loose; cast-iron clamps should be machined. Troubles with mica were due to using the wrong kind of mica. Mica under pressure withstood a high temperature, but if it were loose it would lose its tenuity and fall to pieces. If it were clamped up tight it remained good. It was hardly worth while to lag for more than 1 in. thickness. Oven elements properly designed should have an average life of over three years. Where there was a supply of steam available it ought to be employed, but if it were necessary to generate steam specially, the question of capital cost must be considered. In a recent equipment, not only the water for tea, &c., but a supply of washing-up water, cooking water, and water for baths and wash-bowls was provided, all heated electrically.

Mr. H. A. Ratcliff said that the electrical heating of water was not a commercial proposition with electricity costing more than ½d. per unit. The specifications of the several equipments seemed to point very clearly to the passing of what might be called the "tin-box type" of cooker, but it almost appeared as if manufacturers were going to the other extreme. In the list of advantages of electric cooking he observed that there was no reference to hygienic considerations; he thought they constituted the chief advantages of electrical cooking apparatus; the ordinary naked-flame gas-oven was probably as unhygienic a device as it was possible to have. He was surprised that the author referred to the decreased loss of weight when meat was cooked electrically; if there was a saving it probably arose from a lack of ventilation. The cooking load was bound to clash with the power load, and in winter time there would necessarily be a considerable clashing of the suburban cooking and lighting loads, but as a rule the effect on the mains would be of more consequence than the effect on the generating stations.

Mr. H. Allcock had recently formed the opinion that the design of electrical cooking apparatus, especially that of boiling plates, was now in the critical stage when the working voltage was an all-important factor. Some plates he tried on a three-wire 250-volt × 250-volt system with the middle wire earthed had very short lives. One trouble appeared to be the development of hot spots, due either to faulty heat distribution or to the disintegration of the mica—in any case the heating element in the plate broke down to earth. In fish frying it was essential to bring the fat to a very high initial temperature, to plunge the fish into it, and to replace the loss of heat very rapidly. The electric fish fryer was handicapped because the rate of heating was less rapid than in the case of a gas-heated fryer. Reliability was much more essential than any other factor when designing an electrical kitchen.

Mr. H. R. Burnett said that in order to obtain a large consumer for electrical cooking they must be in a position to convince him that the total running cost of electricity would not exceed that of gas. Hot-plates of the black type were satisfactory for canteen work, but domestic consumers would never be satisfied with this type of hot-plate, the invariable complaint against them being that they were too slow. The radiant hot-plate, on the other hand, gave great satisfaction. This type of plate was now being used in very large numbers in Barrow.

Mr. H. D. Symons said that the point of view of convenience was not sufficiently appreciated; convenience was frequently to be considered before cost. The actual cost for energy was very small compared with the cost of the materials cooked. The softening or disintegration of mica when subjected to high temperatures was due to the dehydration of the moisture of crystallisation, and those micas having the highest percentage of moisture of crystallisation were the best for use in the manufacture of heating elements. Nevertheless, it was only a question of time before the best mica, when subjected to a temperature of 400 deg. to 500 deg. C., would disintegrate.

Mr. H. T. Wilkinson said those who dined at the Club that night had a dinner cooked by gas. This installation was put in originally because capital expenditure was an important matter when starting a club; also the Gas Committee made a tempting offer of free apparatus. Now that the membership had so much increased an extension to the cooking apparatus was necessary to ensure quick service, and they had decided to install the all-electrical apparatus. Although the capital cost was heavy it was justified, for the following reasons:—An additional hot cupboard was necessary to ensure quick service. They had not found the gas hot-cupboard satisfactory. The gas burners gave trouble. The heat was unequal, and dried up the food. They found the gas grill unsatisfactory, as it was necessary to wait about 20 minutes before one could get a chop or steak. It took 10 minutes for the grill to heat up before it cooked at all. The installation of more gas apparatus would have involved another large iron hood, which would have been expensive and awkward to fix in the centre of the kitchen to get the fumes away. They had already had to install a fan in the kitchen to exhaust the fumes, as the staff suffered in health. The running cost would be approximately the same as with gas, more especially considering the high cost of meat and the possibility of reducing the loss in weight. The cost of gas-cooking was about 0.9d. per meal served.

Mr. A. S. Barnard said that at a works just outside Manchester there was a 20-kw. electrical kitchen catering for 80 to 100 people every day. The electricity for cooking the dinners averaged ¼ unit per meal.

Mr. W. A. GILLOTT, in reply, said that with electricity at ¾d. per unit or under, and gas at 2s. 8d. per 1,000 cu. ft. or over, he would certainly install electrical apparatus as being the better proposition, taking into consideration running and maintenance costs, convenience, and fire risks. Mr. Thomas seemed to fear an increase in price of electricity when electrical cooking became more general. In the early days when lighting was the mainstay, low rates were quoted to induce consumers to use motors. In the majority of cases the station peak was now caused by the power load, and the rates had come down, and he thought the same would apply to electrical cooking. The washing-up arrangements shown in his fig. 3 were a distinct improvement upon the machine described by Mr. Thomas. This kitchen was in a canteen where all meals were served first, and no soiled plates were collected until the diners had finished their meal. The plates, &c., were collected and placed in wire frames in which they were washed, sterilised, dried, polished, and stacked. The self-contained apparatus in the schedule could not, in his opinion, be reduced if good results in the kitchen were desired. The question of meat shrinkage was really a secondary consideration; he did not agree with the figure of 3 per cent. only in favour of electrical cooking. He had carried out tests where the shrinkage had been only 5 per cent., while there was as much as 57 per cent. shrinkage with a coal-fired oven. Wiring faults were mostly in flexible metallic tubes. By the adoption of solid type connections on certain apparatus these faults had been overcome. It was not necessary to provide for a rapid ventilation with an electric oven, as no combustion took place, the only ventilation necessary being to carry off the steam from cooking, which was provided for by a small hit-and-miss ventilator. In Newcastle they did not find that the cooking load clashed with the power load. With self-contained vessels he had not experienced any difficulty in fish frying. He had tested both the closed and open or radiant type of hot-plates; the closed plate had the advantages of longer life, more robust construction, and better facilities for heat regulation; the open or raidant type was only better for the first "boil." To provide heat regulation one must either use a duplicate winding or employ a thin wire, which resulted in a short life. He did not think much saving would be effected by the use of thermostatic control in ovens, but they could be employed with advantage in water-boiling and soup-making in large quantities. Mr. Symons apparently arrived at the conclusion that the convenience of electrical cooking was to be taken into consideration when the consumer paid his electricity bill. This was not the case; on the score of running cost alone, electricity was cheaper than gas, on the basis of ¾d. per unit and 2s. per 1,000 cu. ft. He considered fireclay or similar material to be more suitable than mica for grills of the restaurant type.

## NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,138. "Control and protection of compound-wound electrical machines." J. E. GOODWIN. April 29th.

7,164. "Electromagnetic brakes, clutches, ratchets, &c." E. C. VILLIERS. April 29th.

7,175. "Secondary batteries." Q. MARINO & C. BOWEN. April 29th.

7,178. "Distributors for high-tension ignition devices." R. BOSCH AKT. GES. April 29th. (Germany, May 26th, 1917.)

7,181. "Dynamo-electric machines." SIR C. A. PARSONS & J. ROSEN. April 29th.

7,188. "Apparatus for chemical and electro cleaning and depositing metals." J. J. MAYROW. April 29th.

7,205. "Ignition of internal-combustion engines." L. E. CLULEE. April 30th.

7,212. "Electrical terminal attachment." E. G. ILEY. April 30th.

7,226. "Ignition magneto for explosion engines." R. F. BASSI. April 30th. (Italy, June 30th, 1917.)

7,244. "Magnetic apparatus for indicating vertically and orientation in inclined bodies subjected to centrifugal force." J. T. CLARKE. April 30th.

7,245. "Manufacture of the metal magnesium by electrolysis." E. A. ASHCROFT. April 30th.

7,252. "High-frequency signalling." WESTERN ELECTRIC CO. April 30th. (U.S.A., September 5th, 1916.)

7,261. "Driving mechanism for magneto lamps, &c." O. JUNGHANS. April 30th. (Germany, May 14th, 1917.)

7,281. "Contact-breaking devices for magneto-electric machines, &c." E. F. HOLBROOK. May 1st.

7,308/9. "Machine switching telephone exchange systems." L. POLINKOWSKY & WESTERN ELECTRIC CO. May 1st.

7,313. "Double-current dynamo machines." R. BOSCH AKT. GES. May 1st. (Germany, May 15th, 1917.)

7,314. "Double-current dynamos for switch installations." R. BOSCH AKT. GES. May 1st. (Germany, June 1st, 1917.)

7,325. "Electrical distributors for internal-combustion engines." PULLER ACCUMULATOR CO. & A. W. B. WILSON. May 1st.

7,355. "Means for regulating and measuring alternating magnetic fluxes and forces in testing machines, &c." B. P. HALGH. May 2nd.

7,356. "Jointed arms or brackets for incandescent electric or gas lamps." H. C. TOFIELD. May 2nd.

7,364. "Electric starters and controllers." E. SCHATTNER & J. R. WALTON. May 2nd.

7,387. "Accumulator cell, and method of making same." H. S. HAWKINS. May 2nd. (U.S.A., May 2nd, 1917.)

7,406. "Device for locking incandescent electric lamps in their holders." G. F. COLSON. May 3rd.

7,426. "Arc lamp lower-carbon holder." C. E. LOVESEY & E. R. STEWART. May 3rd.

7,432. "Electrical instrument and method for detecting immersion, passage, and presence of metallic bodies in fluids." F. S. THWAITES. May 3rd.

7,443. "Convertible electric fire." E. A. WELSCH. May 3rd.

7,444. "Electromagnetic trench mortar." A. S. MONK. May 3rd.

7,450. "Electric vacuum cleaners." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) May 3rd.

7,483. "Electromedical apparatus for diagnosis and treatment of partial deafness." E. E. GREVILLE. May 4th.

7,491. "Slip-rings for magnetos, and manufacture thereof." F. B. ESTCOURT, T. W. FIELD ENGINEERING CO., T. W. FIELD & T. R. JONES. May 4th.

7,513. "Insulator carriers for overhead telephone, &c., wires." H. W. LAXTON. May 4th.

7,514. "Methods of connecting electric conductors." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) May 4th.

7,517. "Magneto generators." ELLIOTT BROS., & E. F. HOLBROOK AND W. PHILLIPS. May 4th.

## PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

### 1916.

10,627. ELECTRICAL TRANSMITTING APPARATUS APPLICABLE TO CONTROLLING ADVERTISING AND OTHER DEVICES FROM A DISTANCE. H. K. Harris. July 27th, 1916. (114,633.)

### 1917.

555. TELEGRAPH PRINTERS. E. E. Kleinschmidt. January 11th, 1917. (114,636.)

3,274. DYNAMO-ELECTRIC MACHINERY. Lancashire Dynamo & Motor Co. and G. E. Mason. March 6th, 1917. (114,638.)

4,196. ELECTRICAL TRANSMITTING APPARATUS APPLICABLE FOR CONTROLLING ADVERTISING AND OTHER DEVICES FROM A DISTANCE. H. K. Harris. March 23rd, 1917. (Addition to 10,627/16.) (114,646.)

6,461. ELECTRIC STARTERS FOR INTERNAL-COMBUSTION ENGINES. M. S. Conner. May 7th, 1917. (114,690.)

6,631. MOMENTARY CONTACT ELECTRIC SWITCHES FOR CANCELLING MINING VISUAL SIGNALS. G. Saint. May 10th, 1917. (114,693.)

7,122. RADIO-SIGNALLING SYSTEMS. L. de Forest & C. V. Logwood. May 23rd, 1916. (107,001.)

7,449. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. T. H. R. Key. May 23rd, 1917. (114,703.)

8,467. ELECTRIC VOLTAGE REGULATORS. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 13th, 1917. (114,715.)

8,579. WATERTIGHT FITTING FOR ELECTRIC LAMPS AND THE LIKE. W. Harrison & R. E. H. W. Eyre. June 15th, 1917. (114,719.)

8,627. PROTECTIVE APPARATUS FOR DYNAMO-ELECTRIC GENERATORS. W. T. Tallent-Bateman. June 15th, 1917. (Addition to 1,671/15.) (114,720.)

9,111. ELECTRICAL CONDENSERS FOR HIGH-TENSION AND HIGH-FREQUENCY CURRENTS. A. Kowalski. June 24th, 1916. (108,468.)

9,480. PROTECTIVE APPARATUS FOR ALTERNATING ELECTRIC CURRENT CIRCUITS. H. Pearce. June 30th, 1917. (114,729.)

10,191. ELECTRIC VALVES OR SAFETY DEVICES FOR THE DISCHARGE OF EXCESS VOLTAGE. G. Giles. July 13th, 1917. (114,739.)

12,572. ELECTRIC HEATING AND COOKING APPARATUS. G. Pate & A. R. Wood. September 1st, 1917. (114,757.)

12,611. VEHICLE LAMPS. H. Lucas & W. H. Egginton. September 3rd, 1917. (Cognate application, 1,604/17.) (114,758.)

13,029. RHEOSTATS. Sykes Interlocking Signal Co., W. R. & R. W. TARRANT. September 11th, 1917. (114,761.)

14,932. ELECTRIC FURNACES. J. L. Dixon. October, 1916. (111,103.)

15,840. ELECTRIC TORCHES. R. E. H. Fletcher. October 31st, 1917. (114,777.)

16,800. SPARKING PLUGS FOR EXPLOSION MOTORS. P. G. Mitard. November 15th, 1917. (114,781.)

### 1918.

2,018. THERMIC TELEPHONES AND MICROPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 27th, 1917. (114,418.)

**"Overshooting" with Tungsten Lamps.**—In the *Electrical World* of March 2nd, Mr. C. J. Berry discusses the initial rush of current caused by the resistance of the cold tungsten-filament lamp being low compared with its resistance when hot. In the vacuum type the ratio is about 1 to 11·5, and in the gas-filled lamp 1 to 14·6. The author finds that the maximum current is reached in 0·0004 to 0·003 second, and the current falls to normal in 0·1 to 0·2 second. The maximum current is from 12 times the normal in a 75-watt gas-filled lamp to 7 times in a 1,000-watt lamp. There is absolutely no cause for fuses to blow or circuit-breakers to open when a lamp load is thrown on, provided that the cut-outs are properly rated for the load, as the effective current during the brief period of 0·1 to 0·2 second is only about double the normal value.

**Portable Sub-station for Serving Emergency Loads.**—The Portland (Ore.) Railway, Light and Power Co. has equipped a flat car so that it can be dispatched to any industrial plant in its territory which has a railroad siding when a sudden demand for electric service is made. This portable sub-station is used to supply energy temporarily until permanent equipment can be installed. It has been found especially useful in serving factories when their isolated plants break down. The equipment carried on this flat car includes a 400-KW. rotary converter, three 11,000/440-volt air-blast transformers, a 28-in. motor-driven blower, and the necessary switching and measuring apparatus. Over the equipment is built a wooden framework which can be covered with asbestos and tar paper to protect the apparatus from the weather. After the car is hauled to the place where it is to give service the weight is taken off the springs by jacking up the body, thus preventing excessive vibration during operation.—*Electrical World.*